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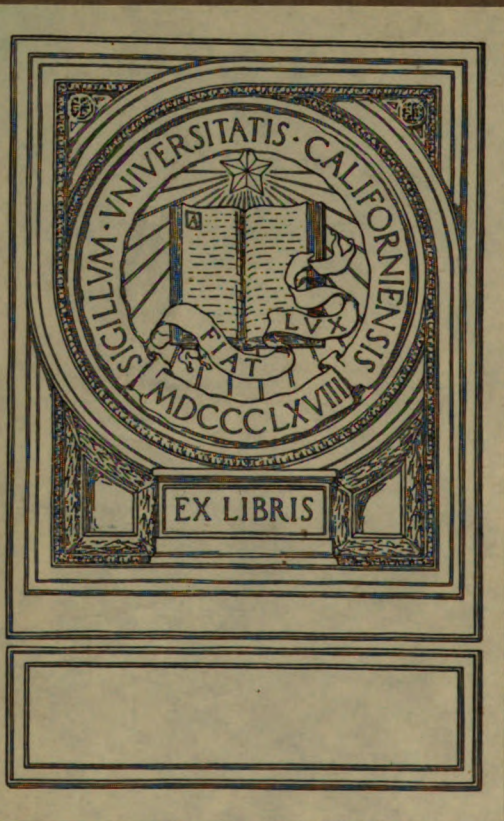
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# **COST ACCOUNTING.**

## **PRINCIPLES AND PRACTICE**

By

*Maroon*

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**AS TO PRESENTATION**



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## PREFACE

Hardly any other feature of industrial procedure has been so necessary, yet so slow in developing, as cost accounting—so rich in possibilities of usefulness for the management of a business, yet so widely considered for many years as a doubtfully necessary evil.

In view of the elaborate detail required for adequate study of cost, and of the fact that most cost installations have had the final objective merely of fixing selling prices, the aversion of careful managers to the expense involved can be fully understood and largely justified.

The credit for slowly but surely forcing the issue of cost accounting belongs chiefly to the accounting profession. Failure to prepare financial statements oftener than once a year has long been recognized by accountants as in every way risky and unbusinesslike. Continual driving for the objective of analytical costs, in the effort to obtain a reliable basis for proper selling prices, has largely been responsible for the development of methods of assembling costs which have now become live and valuable mediums of managerial control.

In working out these results, however, the contribution of the engineer, with his mechanically practical mind, has been an indispensable factor. Largely through the work of the engineer methods of control have been devised which not only facilitate the final aim of accurate knowledge of cost of product but render nearly every step in the cost-finding process a dependable support to those responsible for the operating activities of the plant. When a properly functioning organization has the support of the data thus obtained, the beneficial results in the profit and loss account are a natural consequence.

The course of development of cost accounting—that is to say—has made it evident that to succeed at this work a man needs training along both accounting and practical lines. The engineer or practical shop man must master the principles of accounting in order to insure accuracy. Similarly, the accountant must be fortified with sufficient practical and mechanical knowledge and experience to know what he is dealing with, if his analysis of cost records is to command the sympathy and support of foremen or to be accepted by the management as a useful managerial instrument. In the industrial world of today the number of men thus broadly equipped is by no means large.

It is a source of great satisfaction that the universities are so generally turning their attention to cost accounting and allied subjects which mean so much to the economic welfare of the nation.

In preparing this text for students of cost accounting in universities and elsewhere, one principal aim has been to keep always in the foreground this close relation between accounting and management. The authors have sought not to compile an encyclopaedic handbook of the subject, but to outline in coherent and closely knit order, the essential steps in cost procedure for industrial enterprises of whatever character.

To this end the material is so arranged as to present first in Chapters I to XXVI the entire technique of cost accounting in unbroken sequence. Matters involving what may be termed the philosophy of the subject, which demanded for clear comprehension a full perspective of the flow of procedure, are taken up later, in Chapters XXVII to XXXVII. While it may be advantageous in certain cases to take up some of these points in conjunction with the technical chapters, it has been deemed wise not to complicate too much what may be the student's first approach to cost accounting by interweaving the two types of subject matter.

As a special aid in visualizing the entire flow of cost procedure, a chart definitely outlining the successive steps in the procedure has been prepared. This chart should be studied in conjunction with every technical chapter. In this connection also the forms and records necessary to take care of the successive steps in procedure are outlined in Chapter V, "Mechanism of Cost Control." As the student begins the study of each technical chapter he should turn back to this *index chapter*, as it might be called, and study the portion which bears on the chapter under consideration.

In connection with the preparation of this volume the authors desire to express their appreciation of the courtesy of C. E. Knoeppel and Company, Inc., in making available the valuable technical material in their files.

The authors are specifically indebted to Professor F. H. Elwell, of the University of Wisconsin, for the use in the Appendix of the C. P. A. problems collected by him.

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JOHN P. JORDAN  
GOULD L. HARRIS

New York City,  
September 1, 1920





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**COST ACCOUNTING**  
**PRINCIPLES AND PRACTICE**



2000

## CHAPTER I

### WHAT COST ACCOUNTING IS

#### **Relation of Cost Accounting to General Accounting**

The purpose of cost accounting, a branch of general or commercial accounting, is to provide detailed information as to the separate components of cost which have entered into a product. General accounting shows merely the total profit or loss of the business as a whole; cost accounting shows the profit or loss on each unit, whether the unit be the job, contract, line of product, operating department, or process. It is "accounting for units" that differentiates cost accounting from general accounting.

In a plant with a cost system, however, cost accounting and general accounting are carried on concurrently. A close relation exists between general records and cost records. In fact, the two classes of records in a modern cost system are "tied up," or unified, by the use of controlling accounts, such as Raw Material, Work in Process, Finished Product, and those used for the analysis of expenses.

Theoretically, any type of accounting which discloses the result of the operations of the various divisions of a business, such as the system used in department stores or the system used on farms, might be called cost accounting. In common usage, however, the term "cost accounting" is applied only to that type of accounting which deals with the costs of the operations of an institution producing a line of product, and so the principles of cost accounting discussed in this book are explained and illustrated in their application to manufacturing rather than to merchandising concerns. Manufacturing firms most sorely need the details of cost.

**Insufficiency of General Accounting**

With a good system of general accounting, the manufacturer can ascertain at the close of each fiscal period the amount of his total profit or loss. If the books show a profit, he may be satisfied even though it is small. If, however, a loss has been suffered, the books may not be in such detail as to enable him to ascertain the cause or the way to prevent future losses. Unless prices in the trade are rising, the remedy of increasing his selling price is not open to him, as he must meet the competition of fellow-manufacturers. In order to determine whether or not he can continue to manufacture his various articles profitably, he must have a system which will show the costs and profits of his different products. A general accounting system will not do this; a cost system will. With a cost system the manufacturer can concentrate his efforts on manufacturing and selling the more profitable lines, and at the same time be able to reduce his costs through the knowledge given by the detailed figures.

General figures may be misleading. A concern as a whole may be making satisfactory profits, yet some departments may have to carry the losses of others. If a good system is installed, such conditions will be disclosed. A manufacturer, to be sure, may maintain some departments at a loss, simply because of their advertising value. He should do so, however, with his eyes open. Such a policy can be controlled intelligently only when actual costs are known.

**"Selling" a Cost System**

The demand for the services of the cost accountant comes primarily from the progressive manufacturer who knows that his plant's progress can be accelerated by substituting a cost system for a general accounting system, or by improving the existing cost system. The special opportunity of the cost accountant concerns itself, however, with the manufacturers

who have not seen the light. There are still a vast number of manufacturers who have not yet realized that a general accounting system has serious limitations. Many more look upon a cost system as a mere salvaging device. If the cost accountant can make clear to these men the justification for cost accounting—can “sell” the idea—the possible growth of his business is very great.

If the cost accountant has to “sell” a cost system, however, he must be able to answer satisfactorily the objections raised by the manufacturer and be able to explain convincingly the numerous advantages of a worth-while cost system. Since the manufacturer’s objections to a cost system must be overcome before he can fully appreciate its advantages, his common objections are here discussed first.

#### **Objections Made to Cost Systems—I. Uniqueness of Business**

Many manufacturers object to a cost system on the grounds of the peculiarity of their businesses. They feel that even though a system is adequate for competitors it will not apply to their own unique concerns. In fact, this feeling may even cause the manufacturer to believe that no system whatever could be devised to furnish him with accurate costs. This feeling is mistaken, as, while it is true that each business has its distinctive peculiarities, these are often exaggerated in the minds of the owners. Uniqueness itself does not preclude the possibility of designing a satisfactory system of accounts.

Ideal cost systems, it is true, cannot be installed readily in all firms. The difficulties in installation may be owing to numerous technical operations, or they may be owing merely to opposition on the part of the management and workers, which sometimes cannot be entirely overcome. Nevertheless, while this opposition may be discouraging, it should not prevent the installation of practical features which would improve

the existing system. In certain circumstances it is good policy to install only the most important at first, and to extend their application and add new ones as the co-operation of managers and workmen is gained.

Trade association conventions, and the dissemination of cost information through the medium of the collecting, compiling, and distributing agencies of such associations, have changed the feelings of many proprietors that their concerns are unique and unadapted to cost systems. Many manufacturers have come to realize that the "other fellow's" problems are much like their own.

## **2. Opposition of Managers and Workers**

The fact that in many cases managers, foremen, and workers are opposed to a cost system is frequently put forth as an argument for its rejection. It is true that internal opposition, rather than the character of the system itself, or the inability of the cost accountant, has caused the discontinuance of many cost systems. For this reason, the antipathy of all persons concerned must be overcome. The desire of every cost accountant, therefore, should be to gain the good-will and co-operation of the management and workers before attempting to put in a system. So important does one reputable cost accountant regard mutual understanding, that he absolutely refuses to install a cost system unless he is given permission beforehand to include interest on invested capital in the manufacturing costs. All known differences of opinion should be ironed out before installation begins. Indeed, successful cost accountants attribute a large part of their success to their knowledge of the human factor.

## **3. Cost of Installation and Operation**

Another common objection to a cost system is that the red tape involved makes the installation and operation of a

cost system too expensive. The term "red tape" is relative. What is needless formality in one concern may be essential in another. The mere statement that a cost system has too much red tape, without further explanation, is not a valid objection.

Red tape, when actually found, is misapplied, or too much, system. The complexity of a system is no guarantee of its accuracy. For example, one factory for a long time charged Advertising and credited Stable Garage Expense for advertising placed on automobiles. The question of installing a cost system should receive the same sort of consideration as any other question which bears on factory efficiency. Do the advantages of the cost system outweigh its disadvantages? While the expenses of installing and operating a cost system are treated as expense items in the profit and loss statement, the benefits derived from such outlays continue year after year. In reality, therefore, a cost system is an investment rather than an expense. A cost system, however, like any other investment, should be used intelligently if it is to be a source of profit. It is only a diagnosis of business ills—not a cure for them.

#### 4. System Unnecessary

Another objection that a manufacturer will frequently make to a cost system is that he is in such close touch with his business that he does not need a system. He may state with a good deal of pride that he has made money and does not need any newfangled notions involving additional expense for clerical hire.

Inertia, too, is a powerful factor in his reasoning. An inherent reluctance to adopt new methods is too prevalent. This unwillingness brings to mind the story of a mountaineer who followed his father's custom of placing a stone in one end of his grain sack in order to balance it on his

saddle before starting to the mill. A tourist suggested that the stone be left out and the grain distributed equally in both ends of his sack. The mountaineer replied emphatically, "What was good enough for Dad is good enough for me." The "business graveyard" is full of concerns whose managers had similar feelings.

A cost system should be accepted or rejected on its merits. Expensive ones have been discarded before they have been given a fair trial. Cost accountants are not infallible and their work is not always of a high grade. As a result, cost systems have been junked because they were inherently faulty, or because they have been improperly operated, even though practicable.

### **Assistance from Agencies in Overcoming Objections**

A convincing selling talk is easier to make today than a decade ago, because opposition to cost systems has been decreased by the campaign of education conducted by numerous agencies, such as trade associations, the National Association of Manufacturers, the Federal Trade Commission, the National Association of Cost Accountants, and others. These agencies are disseminating information which has disclosed the value of a cost system to many who were formerly ignorant of its advantages. Nevertheless, despite the good work of such agencies, too many manufacturers are still unaware of the value of a cost system. The cost accountant should be able to state forcefully what its advantages are.

### **Advantages of a Cost System—I. Accurate Unit Costs**

One of the most important advantages of a good cost system is that it shows accurate unit and total costs. A progressive manufacturer wants to know the costs of his individual units of product. Total costs alone do not satisfy; neither do average costs for the business as a whole. An

actual case will illustrate this point. Two manufacturers, A and B, produced several grades of soil pipe. The former kept only average unit costs for all products. The latter recorded separately the exact unit costs of his different products. At the close of a fiscal period A's profits were disappointing because his gross sales had been large. An analysis of his sales showed that most of the increase was in one line. A calculation of the costs of this line showed that he had been selling it below cost. Since B had realized that he could not meet A's "below cost" price, he had been gradually discontinuing the manufacture of this line and buying it from A. Most of A's sales had been made to B, and A's ignorance of his exact costs had forced him to the verge of bankruptcy.

With exact costs, profitable and non-profitable lines are clearly recognized. Thus, sales departments can select the lines on which to allow commissions, can decide on the amounts of commissions, and can choose the lines to "push." Unprofitable lines, it is true, are not always abandoned. They may be continued—

1. For the sake of their advertising value.
2. For the purpose of completing a line.
3. For maintaining production in slack seasons because of organization and equipment which is expensive, due to the fact that part of the overhead is fixed, and continues regardless of changes in the volume of production.

The overhead formerly charged to a product which is no longer being made must be borne by the products still being manufactured. If the production of the remaining units is increased sufficiently, thus taking up the "slack," so to speak, higher unit costs do not necessarily result. The main effort is to increase the sales of the paying product.



## 2. Aids All Departments

One advantage which is too little appreciated is that a cost system aids all divisions of an enterprise—the production, selling, and financial. Cost records should not be regarded simply as post-mortem data. While auditors should not use accounting data for purposes of prophecy, the cost accountant works under no such ethical prohibition. One of the chief functions, indeed, of the cost accountant is prophecy. Aided by him, the production and selling divisions use the historical value of records as an aid to prophecy. Instead of looking backwards, they scan the future, so as to detect anything which indicates a squall or a storm. Many progressive financial managers and treasurers estimate immediate and future capital requirements with the aid of cost data. Thus they prevent the tying up of too much capital in inventories, and can arrange with commercial banks for seasonal loans to be used in carrying the “peak” load of the business.

In order to accomplish this triple purpose, cost data should be timely, and available for analysis shortly after the close of each cost period. If the data are slowly assembled, it is impossible for the production division to ascertain the causes of cost fluctuations in time to apply effective remedies. In the old phrase, it is of no avail to lock the barn after the horse is stolen. The sales division wants prompt information also. It should not be forced to plan its campaigns on the basis only of normal or average costs. It needs up-to-date information of current and unusual costs in order to push sales with vigor and intelligence. Much of the value of a cost system is lost by the financial division unless the cost of *current* units can be studied. Unfortunately, there are still many non-progressive financial divisions that are interested in the “where, when, how, and why” of disbursements, and are apt to regard records as mere history. The influence of progressive officials, however, is making itself felt. When the

soundness of their view is universally recognized, prompt assembling of data will be regarded as a necessary characteristic of a usable cost system.

### 3. Waste Eliminated

In all industries, idleness of machines means a dead loss and should be reduced as much as possible. Cotton manufacturers, for example, cannot always sell their product at their own figure. They may be forced to sell in a "buyer's market" or to let their machinery stand idle. A great advantage of a cost system under such circumstances is that it shows the mill-owner the fabrics which afford the largest returns and which therefore he should manufacture.

Concerns which manufacture new specialties that are patented, frequently have no cost systems because the selling prices are much higher than possible costs. Even in such cases, however, much waste could be eliminated if costs were known. As the date approaches on which the patent expires, the need for a cost system increases, because the advantage of the patent does not exist after the expiration, except as it may have built up good-will. Even a more important reason for a cost system in this case is that more money could be made during the life of the patent with a cost system than without one.

### 4. A Basis for Fixing Selling Prices

It is impossible to fix intelligently the selling prices of products unless costs are known. As Lord Bryce has remarked: "Three-fourths of the mistakes a man makes are made because he does not really know the things he thinks he knows." It is no longer safe to operate a business by simply adding to prime cost an arbitrary percentage deemed sufficient to cover both factory burden and selling and administrative expenses, and then to trust blindly that the selling price will

be high enough to cover all costs and to allow the desired margin of profit. In many concerns today, costs are figured in no such blind fashion but are carried to the fraction of a cent. That fact often turns failure into success.

These detailed costs depend largely on the time necessary to make the product. Indeed, according to an advanced concept of modern management, the ultimate unit which is sold in a producing or trading business is time, namely: the time of the machinery and equipment, the time of the employees, the time capital is tied up in raw materials and supplies, and the time of management. It would seem fair, therefore, to charge higher for the products which require the greatest amount of time components, considering, of course, the costs thereof, and assuming that the use of time is economical; and to charge higher for work of a complex nature than for work which is simple.

### **5. A Basis for Standardizing Costs**

The cost used as a basis in fixing selling prices should be the standard costs of normal production rather than abnormally low costs or abnormally high costs. Standard costs occur, according to some authorities, when the plant is running 80% or 90% of its possible capacity. If the plant is running overtime, production is above normal and costs are below normal, provided the concern is operating under the law of decreasing costs or increasing returns; selling prices based on such costs may be inadequate to cover the costs when production slumps. On the other hand, if selling prices are established when production is below normal and the costs above normal, they may be above the competitive level; as a result, only a small volume of orders may be secured. Thus the importance of standards is seen. Standards are not immutable; they often change overnight. While they are fixed and applicable, however, their worth in planning and

in enabling comparisons to be made against them is inestimable.

One valuable feature in standardizing costs is the pre-determination and application of standard or normal departmental burden rates. (See Chapter XVII.)

Inasmuch as cost systems enable manufacturers to determine standard prices, and therefore facilitate price-fixing, a few economists believe that the adoption of uniform cost systems will paralyze the vigor of our prevailing system of competition. Standards, however, are not always observed. For example, manufacturers may openly or secretly fix selling prices in defiance of law instead of basing them on their own individual costs. After leaving the "price-fixing" conference, many manufacturers book orders at a price lower than the "set" price. This fact tends to show that a uniform cost system per se does not result in secret price-fixing.

It is granted, however, that the use of such systems tends to stabilize prices by reducing cut-throat and ruinous competition which has been due to ignorance of accurate costs. Moreover, a more widespread use of cost standards would have prevented many uneconomical consolidations. Consolidations of competing firms often disclose the fact that the selling prices of some of the constituent firms have been below cost. Any manufacturer who produces without a knowledge of costs is a gambler. He is a menace to his trade and the community at large.

### **Two Business Fundamentals**

In determining selling prices the manufacturer should hold in mind two business fundamentals:

1. "Every manufacturer who furnishes a product of good quality and who can make reasonable deliveries, is entitled to his share of the available business at a fair and reasonable profit."

2. "Any concern which purchases a product below the cost of production is enjoying something to which it is not entitled and which really belongs to the manufacturers of the particular product."<sup>1</sup>

## 6. An Aid in Preparing Statements and Tax Returns

If perpetual inventories for raw materials, work in process, part-finished stock, finished stock, etc., are kept, it is not necessary to take physical inventories prior to the compilation of financial statements. (See Chapter XXIX.) As a result, balance sheets which reveal the financial status of the concern can be prepared monthly; profit and loss statements showing the monthly changes in the financial status of the manufacturing, selling, and administrative departments can also be drawn up; and in addition a statement which includes the sales of each salesman, or the sales for each geographical unit, etc., can be made.

The data in financial statements is also used in preparing tax returns. An honest manufacturer neither wishes to evade his share of the taxes nor to pay more than his share. In order to feel sure that he is preparing correct tax returns, he must know his costs. Probably the income and excess profits tax laws, as much as the intensity of competition, have caused manufacturers to realize the value of a cost system.

Financial statements also have a credit value. A manufacturer can more easily obtain an adequate line of credit if he presents his creditors with accurate and intelligible financial statements based on a good cost system. In fact, some creditors absolutely refuse to grant credit unless the debtor furnishes financial statements. The manufacturer himself, before deciding to extend credit, relies largely on his customer's financial statements. His ability to interpret these statements

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<sup>1</sup> C. E. Knoeppel, "The Philosophy of Costs," *Industrial Management*, September, 1919.

—to create from the figures a picture of his customer's business—reduces considerably his bad debt losses.

Furthermore, the manufacturer must know the sales, costs, and profits of customers' accounts before he can judge as to whether it is profitable to carry certain customers. Such data also enable the manufacturer to decide whether he will sell his goods to his old customers at a lower price than to his new customers, or whether to allow the former some concessions in the way of additional work.

### **7. The Basis for Comparing Periodical Costs and Profits**

With accurate profit and loss statements it is possible to make comparisons for different periods of the costs and profits of the whole business and the subdivisions thereof, such as the operating, selling, and administrative departments, and for the processes, jobs, and lines of product. Furthermore, with detailed cost data a basis is provided for the comparison of total cost and the various elements of cost with the past costs of similar units, with estimated or predetermined costs of the same unit, and subsequently with the cost of similar units. In order to make cost data valuable for comparisons as between different periods, it is often necessary to keep the details in terms of units of material and labor as well as in monetary terms.

By comparing balance sheets as well as profit and loss statements, changes in assets, liabilities, and capital can be ascertained.

### **8. An Aid in Formulating Policies**

After comparisons are made, future policies can be formulated with more assurance, because they are based on accurate knowledge rather than on guesswork. Even so, many of the manufacturer's activities still partake of the nature of gambling. He makes experiments on new designs which

often prove worthless. He hires new employees who do not always come up to expectations, and whose discharge increases the labor turnover.

Despite the growth of scientific methods in business under the competent direction of industrial engineers and cost accountants, manufacturing is still more of a gamble than the banking business and most merchandising businesses. Banks make loans up to a certain percentage of the current assets of the borrower, thus amply protecting themselves. Merchandising establishments operate under a more extensive code of standards than manufacturing enterprises, which minimizes their risks. The hazards of manufacturing, however, are being constantly reduced by standardization.

While standards have long been the buttress of the older sciences, such as the natural sciences, their importance in the science of business has only been realized within recent years. As Clinton E. Woods<sup>2</sup> well states, the standardization of product is the engineer's first problem. Standardization results in the reduction of the lines carried. The most successful plants are the ones with comparatively few lines, because their activities can be consolidated, and more attention can be given to large-scale production if the concern operates under the law of increasing returns (or the law of decreasing costs).

Too many firms vary their production with changes in sales conditions by increasing production as sales increase, and vice versa. In periods of depression, equipment and labor may be idle with the result that unit costs increase. In many cases it would be better to cut the selling prices slightly rather than to "hold the market," because the plant could then run more normally, and turn out product that could absorb the "fixed" overhead, which otherwise would be a dead loss. Production, therefore, should be as normal as possible. It is

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<sup>2</sup> In "Unified Accounting Methods for Industrials," Ronald Press Company, 1917.

helped by standardized equipment which depends on a close correlation between operating departments, so that all may operate as uniformly as possible.

Normal production is also helped by standardization of labor, which materially decreases the labor turnover. One of the aims of scientific management is to bring about a standardization of labor approximating in degree the standardization of equipment which has been accomplished largely through the interchangeability of parts for machines.

### 9. Carrying Out Policies

While immediate steps to effect savings can be taken subsequent to the installation of a system it is not until the end of the month, or later (depending on when financial statements are completed), when comparisons between the costs under the old system and the new system can be made, that the full effect of economies introduced can be felt. As stated, new policies are then determined, and the results are measured at the close of the next fiscal period.

During the period, efforts should be made to reduce wastes of material, labor, and overhead. If cost records are maintained, these wastes can be determined and unnecessary leaks can be remedied. On account of the constantly increasing costs of labor, due among other things to the demands of the workers for higher wages and shorter hours, which if granted do not always increase production, and the increasing costs of material and burden, the manufacturer is forced to do all within his power to decrease the reducible charges. Actual costs aid in predetermining or estimating costs. A predetermination of costs prevents the birth of waste or at least stunts its growth.

It is only by the use of cost records, therefore, that the activities of modern business conducted under the factory system can be visualized, and proper policies formulated and



carried out. In the days when industry was in the handicraft and domestic stages, the need for a cost system was not so imperative, since the owner of the business was intimately in touch with its details. Today this is seldom the case. However, one present-day example of simple management may be cited. A small producer of neckties has his business in a small room with his desk in the center and his operatives around him. A shortage of labor or materials, or a breakdown in machinery is soon discovered. Contrast the situation of this manufacturer with that of the president of one of our largest corporations today. It is a physical impossibility for him to be present in all of the operating subsidiaries. Hence, he must rely on records in visualizing the conduct of the business in all its ramifications. With a cost system tied up with the general records by means of controlling accounts, his sight is intensified, and he becomes a modern Argus.

## CHAPTER II

### COST COMPONENTS

#### **Concepts of "Cost"**

Before total costs may be assembled and the goal of cost accounting reached, all charges which make up those costs must be recorded separately and in detail. This raises an inquiry as to the meaning of the term "cost." The conceptions of the term are by no means uniform; but the various concepts of cost can at least be grouped into two main classes: (1) non-technical, and (2) technical. Each of these two classes might be subdivided. Under (1) would fall the individual's and the economist's concept of cost; and under (2) the merchant's and the manufacturer's concept of cost.

#### **Non-Technical Concepts of Cost**

The individual's concept of cost is usually one of outlay. He measures the cost of an article by the amount of expenditure. He says, for example, "My hat 'cost' me \$5."

The economist's conception of cost is essentially the same as the individual's, but he subdivides the costs of an enterprise into its production factors, namely: land, labor, capital, and management. The costs of the factors are rent, wages, interest, and profits. Some economists regard land as a class of capital and not as a separate production factor. Some economists do not consider profits as a cost but as the difference between selling price and costs. A discussion of the economic theories of rent, wages, interest, profits, alternative costs, and opportunity costs does not fall within the scope of

this volume. For that, the reader is referred to any good work on the principles of economics. The interest here lies only in the general concepts of costs and the classifications of cost.

### **Technical Concepts of Cost**

The merchant's first concept of cost is the invoice price of goods bought. This concept does not include items such as freight, cartage, warehousing, insurance, traveling, and marketing charges. The merchant adds these items to his initial invoice cost after goods are received and merchandising plans are put in operation.

Theoretically (as mentioned in Chapter I), any type of accounting which shows costs by "units" can be called cost accounting. But as the subject matter of this book is limited to cost accounting in factories, this chapter deals only with the manufacturer's conception of cost. To him "costs" are heterogeneous, including many and various elements or components.

Every element or component of cost comes under one of the following classes:

1. Direct material, as the wood used in making a chair.
2. Direct labor, as the wages of the employee who makes the chair.
3. Overhead, as supervision, depreciation, etc., chargeable to the chair.

The classes of material, labor, and overhead are multifarious, but the general principles underlying the accounting of each class are the same.

### **Definition of Cost**

Thus cost may be defined, as the term is used in cost accounting, as follows: any payment or charge for direct ma-

terial, direct labor, or overhead, the purpose of which is to create marketable assets—finished product. Various combinations of cost arise in the creation of marketable assets. This point may be made clear by drawing an analogy between a cost system and a water purification system. The impure water flows into a reservoir. It is purified by chemical treatment and as it flows out of the other end of the reservoir it has become a commercial commodity. The expenses of purification have made it a marketable product. Just so, raw material flows into the receiving room. To its cost is added the cost of direct labor and overhead, and the material flows out of the shipping room as a finished marketable product.

It is important to observe that capital expenditures (expenditures for assets) and exchanges of certain assets for other assets are not costs within the meaning of the above technical definition of cost. While the purchase of a machine, for example, in the non-technical sense "costs" money, it is not a cost as the term is used in cost accounting. This purchase with other capital expenditures, to be sure, is entered in the general books of the purchaser, but not in the cost books. This does not mean, however, that the two classes of books are divorced, for, as a matter of fact, they are interlaced into a finished fabric by the thread of controlling accounts.

Although committees of various accounting societies have been working for years to standardize terminology, until a short time ago little uniformity of cost classification, or cost terminology, or cost allocation existed as between different firms even in the same industry. Much has been done recently within given industries—whose members have adopted so-called uniform cost systems—towards uniformity in terms, but little has been accomplished as between unrelated industries. In the main, cost systems are still as different as indi-

viduals. What is a direct charge in one cost system may be an indirect charge in another.

### **Classification of Costs**

Costs may be divided broadly into two large groups:

1. Manufacturing or production
2. Selling and administrative

In the former group are heat, light, power, wages of employees, etc. In the latter group are salesmen's salaries, office expenses, advertising, etc. No attempt is made here to enumerate the various items in the two groups.

One purpose of the classification just given is to enable the costs of the two primary divisions of a business to be ascertained separately. Responsibility for production and for selling and administration should not, under any form of management, be shouldered by one and the same individual. The need of this separation of responsibility is particularly in evidence when the factory and general offices are not in the same locality. If divided responsibility exists, means should be provided to control it. Control is dependent on information with regard to both the manufacturing and the selling branches of the business. The information necessary for control is the cost data. Hence, a cost system should be so planned as to maintain a distinct separation between factory accounts and selling and administrative accounts, and to unify both classes of accounts by controlling accounts. This A B C of cost accounting has been emphasized in cost literature only within recent years, although the principle has been known and observed for some time.

### **Direct and Indirect Costs**

After costs have been classified in such a way as to separate the manufacturing from the selling costs, they must next

be subclassified in order that a maximum of accuracy in recording may be obtained. Costs are therefore further divided into direct costs and indirect costs.

• **Direct costs** are payments or charges for labor and material expended upon a definitely determined unit or product. Small costs, however, are not charged directly to the product, even when the latter can be determined, unless the increased accuracy of the records justifies the clerical work entailed. It follows, therefore, that indirect costs are those which cannot be charged economically or directly to the product. An example of a direct cost is the cost of the raw material in a chair. Indirect costs arise from the following sources:

1. Indirect material—rags used to wipe off chairs and tools; or new tools used to replace those discarded are good examples.
2. Indirect labor—for instance, wages of foremen who supervise the employees in several departments where chairs are made.
3. Fixed charges—depreciation, taxes, insurance, etc.

Adherence to the above cost classification adds to the accuracy of the records for this reason: By charging items directly to the cost units (when economical), the remaining costs (indirect costs) are less than if certain items legitimately "direct" were treated as indirect costs. Indirect costs are distributed over the product in as accurate a manner as possible, but such charging is less accurate than direct charging. For instance, raw material can be accurately measured and charged directly against the chair. The depreciation of the equipment used in manufacturing the chair cannot be determined with any measuring device. It must be estimated. Consequently, the total depreciation of equipment is distributed over all units of product (chairs) made. Any charging, therefore, which reduces the distributable costs, thereby increases auto-

matically the accuracy of the cost records. The growing observance of the principle of direct—that is to say correct—charging has done much to improve the exactness of cost accounting.

The exercise of a little judgment in correct costing more than pays for the effort expended. The salary of a foreman, for example, who works only in department A should be charged only to A. But his pay very often is incorrectly treated as indirect cost and apportioned to several departments, none of which, except A, received any benefit from the foreman's services, and consequently should not be charged with any portion of his salary.

In the early days of accounting, in all probability, no distinction was made between direct costs and indirect costs, since concerns were interested in the total costs of the business and not in unit costs. If one wishes to buy a suit he simply inquires as to the total price. If, however, he wishes to buy only a pair of trousers, or two pairs of trousers with one suit, he naturally ascertains the prices of the separate garments.

### **Necessity of Controlling Costs**

If a druggist wishes to mix a compound, he secures enough of each chemical element necessary to the admixture. In order to obtain the compound desired he requires unequal amounts of different ingredients. Such is true if the mixture is not homogeneous. As mentioned before, costs are heterogeneous. In making his article or product, the manufacturer, assuming that he has his equipped plant, incurs three elements of cost—material, labor, and overhead—which are as diverse as the chemicals of the druggist. The inherent character of these elements, without any productive act of the manufacturer, marks them as distinct. The manufacturer must simply recognize the fact, and model his system so as

to preserve the distinguishing characteristics of each. Furthermore, like things are usually easier to control than unlike things. Two high-spirited horses or two plugs in a team are easier to control than one of each in a team, even granting that the impetuosity of one is partially curbed by the sluggishness of the other, for the reason that two independent wills must be reckoned with, and the same method of control cannot be applied to each. So it is in cost accounting; unlike items require different accounting treatment and different methods of control.

Furthermore, the advent of the factory system and large-scale production has called for large and varied disbursements. The differentiation of expenses is an outgrowth of mass production and the important principle of production today, that unit costs decrease as production increases, assuming that certain overhead items are "fixed."

If different costs are to be controlled, their amounts must be known and compared with past costs and with standard costs. Costs cannot be subjected to the highest degree of control unless they are known, and then compared with standard costs.

### **Relation of Terms: Expense, Burden, Overhead**

Indirect costs—synonymous with overhead costs—are variously termed "expense," "burden," "overhead," and "loading." The English equivalent of "loading" is "oncost." There is some merit in not regarding as synonymous the terms expense, burden, and overhead. The word "expense," for example, might be applied to cost items (other than prime or direct cost) when they are originally incurred and charged to accounts with descriptive titles; for example, Teaming Expense, Heat, Light, and Power Expense, etc. These accounts are split up, broken down, or distributed to various departmental burden accounts. They may, in fact,



first be closed into other accounts which accumulate the expenses of indirect, non-productive, or service departments. These accounts in turn, along with all other expense accounts, ultimately are closed into departmental burden accounts and hence never appear in the unit cost sheets of finished product.

A departmental burden account is kept for each productive department. The word "burden," therefore, would be used as the name of the account which accumulates all costs (other than prime costs) for each productive department. The word "overhead" might be reserved to indicate the entire class of indirect cost, which is in turn divided into "expense" (originating) and "burden" (final).

While the above differentiation between the terms expense, overhead, and burden is in present-day practice not adhered to generally, it is here offered in the interest of clearness.

### **Determining the Selling Price**

Despite differences in terminology, fairly well-defined ideas are held as to items that compose manufacturing cost, which is also known as "factory cost," "production cost," or the "cost to make." These items are direct material, direct labor, and overhead. They make up the cost of finished product, which should not include any selling or administrative expenses. A manufacturing superintendent, for example, who is partly a manufacturing official and partly a selling and administrative official, consequently spends a part of his time in the factory and part in the selling and administrative offices. Hence his salary should be charged to the factory and to the office respectively, in proportion to the benefits that each derives from his services.

To the manufacturing cost of an article is added selling and administrative expense. The sum of these is the total cost of the article or its cost to make and sell. Examples of selling expenses are salesmen's salaries and commissions, traveling

expenses, etc. Administrative expenses consist of salaries of general officers and clerks, etc. To total cost is added the profit desired and the result is the selling price.

### **Philosophy as an Aid to Technique**

An understanding of the philosophy of cost accounting will dignify the technique of the subject. The technique is the road to the desired goal, namely, accurate costs and accurate financial statements. The philosophy of cost accounting interprets the practice of cost accounting. With the aid of correct theory, the accountant sees each cost component in its proper perspective. His vision of the ultimate aims of cost accounting is not obscured by the detailed work—oftentimes of a “hack” nature—which piles up before him.

Just as one must slowly and carefully climb a mountain peak in order to enjoy fully the grandeur of the summit which he knows is there, so the cost accountant must wrestle with the details of his cost system before he experiences the joy of work well done and realizes his ultimate purposes. The subsequent chapters deal with the technique of cost accounting.

## CHAPTER III

### ESTABLISHING THE BASIS OF COST

#### **Necessity for Proper Bases**

There is little doubt that the most prevalent cause of failures of cost systems to operate properly has been the lack of understanding as to the bases on which to figure the costs of the product. It is therefore of the greatest importance to have a full understanding of the various basic methods which may be used in the figuring of costs, and even when the various methods are understood, there is still the problem of definitely settling the combination of these methods to be used in any given plant.

As to units of measure, there is general agreement. Costs may be figured by the piece, by the hundred pieces, by the pound or hundred pounds, by the ton, dozen, gross, or any of the common units of measure. This chapter assumes that the unit of measurement to be used in the final cost is quite automatically known.

It is not always realized, however, that to arrive at a final unit cost involves very often the use of several different units, in some cases perhaps five or six of them. From a series of illustrations in various lines of production, certain general principles may be developed which will serve as guides to a proper analysis of a given problem.

It cannot be stated too strongly that it is absolutely useless to expect to work out a comprehensive system of costs without first establishing the bases on which to work.

In consideration of the ultimate results desired, there must be a final objective which in turn must be analyzed into a series of subobjectives. Only through the accomplishment of

these various subobjectives can the final objective be reached with any useful accuracy.

Not only is it necessary to have a clearly established basis of procedure to accomplish the final objective, but a definite procedure is necessary for purposes of comparison in order that the final figures will be accurate and valuable.

### Grey Iron Foundry Industry

In a grey iron foundry of average size the bases of cost involved are as follows:

1. *Metal Cost.* The metal cost is arrived at on the basis of the total weight of liquid metal delivered from the spout of the cupola. Two items are considered: conversion or melting cost, and cost of metals.

From this it is possible to arrive at a cost per pound of the metal as it is poured into the moulds, irrespective as to whether it is later accounted for in the shape of good castings, bad castings, or "sprue." It should be noted that the basis of this section of cost is the pound.

2. *Moulding Department Cost.* In this department, three separate and distinct bases of cost may be involved:

- (a) Direct moulding labor
- (b) Moulding department burden
- (c) Moulding machine burden

These three items involve three different bases, as follows: The first item involves the direct time of making the mould, which is invariably on a per mould or per piece basis. Even though first regarded on the per mould basis, it is considered eventually on the basis of the number of pieces per day which the moulder can produce and the rate per piece for the direct moulding cost.

The second item, the general burden of the moulding department, should be on the basis of the direct-labor hours

applied to each job. It may also, however, be figured on the direct-labor cost, the difference between the two being explained in subsequent chapters. In any event, the general overhead of the moulding department must be applicable to the job on the basis of the direct hours applied to the job, or the direct-labor cost of the job.

The third item is used when a special rate on account of moulding machines is applied to the cost of a job. In this case the basis is expressed in the number of hours that any particular machine was used in producing the order.

3. *Core Department Cost.* The bases used for the core department are the same as for the moulding department, involving, similarly, the direct labor, the general department overhead, and special charges on account of machines used.

4. *Finishing Department Cost.* The finishing department cost in the usual grey iron foundry is handled on the basis of the combined moulding and core-making direct-labor hours, or the combined moulding and core-making direct-labor cost. In other words, the entire cost, including direct and indirect costs, of the finishing department is carried into the cost sheet on the bases stated above. Exceptions to this rule occur, however, in any grey iron plant where the direct labor may be applied to the orders which pass through the department. For instance, in plants where there is a large amount of repeat work, and where it is possible to charge to each casting the amount of grinding, chipping, etc., the direct labor is applied to the product itself, and the indirect cost of the department is applied in the cost sheet on the basis of the direct-labor hours involved, or the direct-labor cost.

From the foregoing it will be seen that the cost sheet of a casting is made up of pounds of metal, direct-labor charges, indirect expenses on the basis of the direct-labor hours or cost, and finally the finishing cost on the basis of a combination of the moulding and core-making direct costs.

**Wood Box Industry .**

The procedure in the wood box industry may be illustrated briefly as follows:

1. *Dry Kiln Cost.* The cost of kiln-drying lumber is established on the basis of thousand feet. This holds irrespective of the kind of lumber which goes in, although it is necessary, if various grades of lumber are used, to keep the various kinds separate in order to establish a variance in cost.

2. *Planing Cost.* As the planing of lumber is an operation which applies to all product which goes through a mill, this cost should be found on the basis per thousand feet. Irrespective of the final disposition of the lumber which goes through the planers—as a lot of lumber going through is usually diverted later into many orders—it is impossible to consider this cost on any other than the basis of the straight per thousand feet.

3. *Rip Sawing Cost.* After the lumber has been planed, the next operation is to run it through the rip saws. In this operation the final disposition of the material which is being worked on is not known. Therefore, in order to establish any accurate cost basis it is necessary to adjust the cost on the basis of the operation, as in the case of planing.

In this case, however, the width of the material sawed is immaterial, as the main point of consideration is the lineal feet of material passed through the saws. In this operation, therefore, a basic figure of the lineal feet passed through the saws should be collected, and the cost of the operation computed on this basis.

4. *Cross-Cutting Cost.* In this simple illustration it is doubtful as to whether the cost of cross-cutting can be applied to some particular order for goods, or whether the basis of an operation cost must be continued, somewhat similarly as in the case of rip sawing.

Reference to a common practice will illustrate the difficulty in establishing a proper distribution of this particular item of cost. A lot of lumber may be running through, intended for three kinds of boxes. The specification for the first box calls for absolutely clear lumber, that for the second box permits of one knot in each side or end, and that for the third box permits any number of knots in either side or end. The length of the sides and ends in each of these three boxes varies. The sawyer, therefore, may have six gauges to work to.

In drawing through the lumber, he first squares off the end and finds that he can get a full piece of clear lumber for the first specification. He cuts this off to the proper length. He then finds that one knot hole is so close to the end that it is necessary for him to cut the next piece to the gauge representing the end of the box which will permit of one knot hole; this is an entirely different box from the one for which he cut the first piece. The next strip of lumber has three or four knots in it, and he therefore cuts a side for the third box.

This procedure continues throughout the entire run. It is quite evident, therefore, that it would be absolutely impossible to distribute his time as between the three kinds of boxes being produced. One thing, however, is common to all of them, namely, the time required to make the cut. Therefore, in a business where large runs of boxes are being put through, it is quite obvious that the only practical way would be to establish an operation cost based on the cost per cut for the various widths of the sizes involved in the boxes being manufactured. This cost per cut could then be used in compiling the cost of the boxes so far as the direct labor is concerned.

5. *Other Operations.* We can now readily imagine that all other operations in connection with the manufacture of the boxes are peculiar to the particular box being manufactured, permitting no special consideration as to operation

costs. This would then involve the charging of the direct labor to the particular order covering the goods.

6. *Burden Charges.* In all of the preceding operations there is involved at least one consideration, and very likely two, in connection with the distribution of the burden. The general burden of the department is distributed on the basis of the direct-labor hours, or the direct-labor cost. In the case of special machines which require the establishment of a special machine rate, this burden will be charged on the basis of the machine hours applied to the particular work in question.

The foregoing is not intended by any means to be a complete specification of what is involved in a box shop, as in any woodworking plant of this description there are many other problems involved not here mentioned. It will indicate, however, the various bases which may apply, and particularly the fact that the building up of the final cost involves the use of a number of separate and distinct bases.

### **Pipe-Rolling Industry**

Illustrations of bases of other kinds than have been heretofore mentioned may be found in a pipe-rolling industry, starting from sheets of metal cut to the required size for the various sizes of pipe.

1. *Bending and Welding Costs.* In this particular department of a tubemill, the bending and welding is a very large and entirely continuous operation. The sheets of metal are heated, passed through bending rolls, reheated, passed through welding and straightening rolls, and the crop ends cut off—leaving a blank which awaits the further operations in connection with threading and finishing. After the sheet metal has started on the initial heating there is no stop until the actual pipe has cooled down and the crop ends are cut off.

In such a case a gang cost is found which includes all costs actually applied to working the pipe and to the main-



tenance of the equipment used. This cost is reduced to a cost per hour of the running time of the gang.

A tally is kept of the lineal feet of pipe put through in each particular run of a certain size. The charge to this run is on the basis of the hours actually used in making the run. This charge is then divided by either the number of lengths of pipe, the pounds of pipe produced, or the lineal feet of pipe produced, resulting in giving a cost per pound or per foot, up to the point where it is ready for the finishing operations. This cost involves both direct and indirect charges.

2. Finishing Cost. After any one particular size of pipe has been cut off after being welded, there is a possibility of this particular size of pipe being treated in many different ways. It will be remembered that up to this point the cost per foot or per pound has been determined. This cost then becomes the material cost of the orders which call for the various kinds of finishing, and the finishing costs are found on the order basis, which in turn may be subdivided to give the cost per piece, or, so far as the threading is concerned, to give the cost per thread or hundred threads.

For each particular order, the cost per piece will, of course, be the main object. This is determined by charging to the order the direct time of the workers in threading and finishing the pipe. This, therefore, goes as a cost on the basis of the individual piece of pipe, or better still, on the number of ends threaded.

It is possible, of course, that the pieces of pipe vary in length, so that the cost per lineal foot of many runs of the same pipe may have to be recapitulated to arrive at a flat average per lineal foot covering all lengths, if that should be necessary. In computing the individual order, however, it is necessary to take into consideration, for comparative and actual purposes, the number of ends threaded. In addition, it

may be found of value to assemble figures from various runs of like thread to arrive at the cost per hundred threads for estimating purposes.

Another feature of the finishing cost is that of testing the pipe, which for comparative purposes should be figured on the basis per piece of pipe. It makes no difference in testing the pipe what the length of each piece may be.

As in all other departments of this nature, the burden of the department is figured on the basis of the applied direct hours or direct-labor cost, so far as the general burden is concerned, and any special machine charges based on the number of hours each machine may be used on each particular run.

### **Rubber Tire Industry**

In the manufacture of rubber tires there are various bases involved in arriving at a final cost per tire.

1. *Milling Cost.* The various compounds which are involved in the manufacture require different lengths of time for the milling process. It is therefore necessary to find the cost of the milled compound on a pound basis.

2. *Calendering Cost.* The fabric is usually purchased on a pound basis, and in finding the cost of frictioned fabric the material cost enters the records on the basis of pounds for the fabric and also for the milled stock.

The direct time of the operators of the calenders is kept for the particular run of material which is passed through as well as the machine time involved. These charges are made to the run on the basis of the value of the direct labor—as shown by the time cards—for all the labor involved, with its burden on the particular basis which may be used, and for the number of hours of the machine equipment involved. A tally is kept of the lineal feet of fabric passed through the machine, together with its width. All the elements of cost above mentioned are brought together and divided by the square

yards involved in the product finished by the calenders. The basic unit, therefore, in this case is the square yard.

3. *Bias Cutting Cost.* As the bias cutter operates at a constant speed, the labor and burden cost of this operation is on the per piece basis. Therefore, for comparative purposes, the cost of the direct labor with its dependent overhead is figured on the piece.

4. *Other Operations.* Without going further into detail it may be said that the other major operations are largely on an order basis, particularly the building of the tires. In this case, the direct labor with its burden is charged to the orders for each particular size of tire as a result of which the cost per tire is arrived at.

### **Building Up the Basic Plan of Costs**

While the foregoing illustrations by no means are planned to indicate all that is involved in any one kind of industry, they *will* give an idea of what is meant by establishing the basis of cost.

There probably is no industry in which it is possible to arrive at the final cost of the product without establishing a series of many basic cost figures, the various combinations of which in time will produce the final cost. The accuracy of the final cost depends on the intelligence with which the various bases of figuring are established.

One more important point in connection with the establishment of the bases of cost is the *use* of the costs made by the management itself, including in the managerial class the foremen of the plant who are responsible for the production of goods at the lowest cost.

A cost which consists of a lot of figures assembled for the sole purpose of setting selling prices falls short of the requirements of a manufacturing institution. Probably the most profitable result of cost-keeping is that of furnishing the

means of a careful study of various operations, and, as a result, the making of many reductions all along the line. A lot of figures bunched into one total are of no use to the operating department, even though the total may be absolutely correct as representing the cost of a certain piece of product. It is of the utmost importance, therefore, before going ahead with any kind of cost work, to establish bases of cost that will not only give a final cost of product, but give it in such form that all operations from start to finish will be represented in a manner which admits of close regulation.

## CHAPTER IV

### METHODS OF CONTROLLING COST RECORDS

#### Definition of Control Accounts

A control account is an account which is charged or credited with all the transactions in connection with a certain prescribed function of the business. Electric Power, Raw Materials, Work in Process, Finished Product, and the departmental burden accounts are examples.

If costs are to be controlled in such a way as to be of constructive aid to the management and to insure absolute accuracy of figures, a scheme of control accounts must be provided which will furnish a means of complete check on all expense and burden accounts. In addition, there must be a series of asset and liability accounts which automatically provide the figures for a balance sheet.

#### Classification of Control Accounts

The various control accounts may be divided into two classes according to their function:

1. Accounts that control data collected for the purpose of analyzing profit and loss and which therefore are of a transitory nature.
2. Accounts that control the asset and liability accounts, to some one of which all other accounts lead.

#### Accounts Controlling Burden and Expense

The first class of control accounts involves the greater detail, and from a managerial standpoint is the more important of the two. This is true for the reason that the business

either makes or loses money according to the way in which transitory operating costs are incurred. It therefore is of the greatest necessity to have the accounts in which data of a transitory nature are recorded so planned and arranged that an accurate and usable set of figures is available for managerial purposes.

The arrangement and assignment of these accounts depend entirely on the nature and organization of the business. Decisions as to what expense and burden accounts should be opened can be made only after careful analysis. This phase of cost accounting will be considered in full detail in Chapter VI.

The following is an example of the first class of controlling accounts. Assume that a manufacturing concern purchases 60% of its electric power at high voltage, and that in order to render this power serviceable and to produce the remaining 40%, the following equipment is necessary:

1. Transformers to transfer or step down power bought.
2. Two gas engines to generate balance of normal load.
3. Gas producers to make gas for engines.
4. Two steam engines to take peak loads.
5. Steam from steam plant for engines.
6. Storage battery for safety factor.

In this case the ledger would have a control account known as "Electric Power," and to this would be charged all labor, material, etc., used in handling the power situation, as well as the cost of power purchased and the proper proportion of the general expense of the business, which the power account should stand as representing a service department. General expense in this case would include depreciation and other fixed charges.

All costs charged to this account will give the total cost of electric power for the month. The total cost divided by the

kilowatt-hours delivered to the operating departments as shown by meters, will give the cost per kilowatt-hour of producing the power.

### **Standing Order Code for Analysis**

But a control account alone is of limited managerial use, as it does not show in analyzed form the detail of how or why the money was spent. Therefore a code of standing orders should be used through which the detail may be easily and clearly shown. To illustrate the point, a brief code for this power situation is shown. (See Chapter VII for discussion of a complete code.) The index figure of the power department is 10.

#### **Purchased Power**

- 1001 Invoice of Power for Month
- 1002 Labor Transforming
- 1003 Maintenance of Transformers
- 1004 Maintenance of Transformers Building
- 1005 Miscellaneous Supplies

#### **Gas Engine Power**

- 1021 Gas Engine Labor
- 1022 Maintenance of Gas Engines
- 1023 Maintenance of Building
- 1024 Maintenance of Switchboard and Other Electric Apparatus
- 1025 Miscellaneous Supplies Engine House
- 1031 Gas House Labor
- 1032 Maintenance of Gas Producers
- 1033 Maintenance Gas Producers Building
- 1034 Maintenance Coal and Ash Handling Equipment
- 1035 Coal
- 1036 Miscellaneous Producers Supplies

#### **Steam Power**

- 1041 Steam Power Labor
- 1042 Maintenance Steam Engines
- 1043 Maintenance Steam Engines Building
- 1044 Maintenance Switchboard and Other Apparatus
- 1045 Miscellaneous Supplies
- 1046 Steam Charge from Steam Plant

**Storage Battery**

- 1051 Maintenance of Batteries
- 1052 Maintenance of Other Battery Equipment
- 1053 Maintenance of Building
- 1054 Miscellaneous Supplies

**General Power Expense**

- 1061 Administrative Salaries
- 1062 Maintenance General Electric Lines
- 1063 Maintenance General Switchboard
- 1064 Miscellaneous—General

**Apportioned Expenses**

- Depreciation
- Taxes
- Liability Insurance
- General Plant Expense
- Trucking

**Total Electric Power Expense**

This must equal the amount shown by the control account

A comparative cost table of kilowatt-hours produced may be drawn up as follows:

Month	KILOWATT-HOURS		Cost		COST PER KILOWATT-HOUR	
	For Month	Total to Date	For Month	Total to Date	For Month	Average to Date
January....						
February...						
March.....						
April.....						
May.....						
June.....						
July.....						
August....						
September..						
October....						
November...						
December..						

The foregoing illustrations will make the meaning of "control" and "analysis" clear. One is really useless without the other, as the control figure gives no detail, and the analysis or statement of the details is useless unless proved correct by



balancing with the control. This principle should be applied to each and every group of accounts which is in need of cost control, either from a managerial standpoint, or from the standpoint of necessity for actual cost purposes, as explained in more detail in Chapters VI and VII.

### **Accounts Controlling Assets and Liabilities**

Control accounts of the second class, that is, those whose function is to control assets and liabilities, differ from those of the first class mainly in the fact that the analysis of controls in this section is made from more permanent records. They are made largely from stock records, machine records, tool records, and the perhaps slightly less permanent record of the Work in Process accounts for production orders.

In the case of the Raw Material account, the analysis of the control account is entered on a stock record. As explained in Chapter X the stock record may consist either of sheets in book form or of cards. Each item of material has its own individual record, showing receipts and disbursements, which of course indicate the balance on hand. If the balances of all individual items were footed at the close of the month, the total should equal the balance shown in the control account, Raw Material.

Various asset control accounts are opened according to the requirements of the business. For instance, many control accounts may be needed for raw materials alone. It may be desirable to control separate stockrooms, or the magnitude of an individual item may warrant a separate control account, such as Pig Iron in a large steel plant, or Bar Steel in a forge plant.

When stockrooms are controlled by a separate control account, a set of stock records will be set up for each stockroom unit in order that the entire stock may be properly analyzed.

It may not be necessary to have more than one work in process account for the work of each department, but it is usually best to have a control for each component of the cost, i.e., material, labor, and burden. Here an analysis may be made by examining the files of uncompleted orders, where all charges to each order are filed or posted as the work progresses on each production order. If the uncompleted orders are footed at any time, they should agree with the ledger control accounts as set up. (See Chapter XIX.)

### **Use of Control Accounts**

Control accounts might be divided into three specific groups:

1. Accounts with permanent balances, representing inventories and like data.
2. Accounts with accumulating balances through the year which control the operating burden accounts.
3. Accounts which are used each month for the sole purpose of collecting the charges to expense accounts which, after collection, are distributed to burden accounts in the same month.

Brief descriptions may be given as follows:

The accounts in the first group consist of those for raw material, supplies, finished stock, work in process, and all such accounts as hold the value of the various material assets of the company. These accounts are debited with purchases and all new acquisitions, either from the outside, or through changes in the form of product inside the plant, and are credited with records which show the disposition of whatever is represented by the accounts. In the case of materials in stock and finished product, the records of disposition are requisitions and sales or shipping orders respectively.

The accounts in the second group consist of the operating burden accounts, which are carried in the books—as explained later in this volume—in such form as to produce an accumulative balance and thus give a figure at the end of the month which represents the total of the analytical statement of each burden account as it is made up.

The accounts of the third group represent the controls of all such monthly expense accounts as Electric Power, Teaming, etc. These are collected in order to show what each expense amounts to for the month, giving a total figure to be accounted for on the detail statement of each expense. As these accounts, after all charges thereto are in, are split up immediately and charged to the various operating burden accounts, they become simply verifying accounts to assure the exactness of the distribution to the operating accounts.

### **Progress of Data Through Control Accounts**

The use of control accounts is in reality very simple. Once they are understood, they are readily appreciated, first because of the absolute assurance they give of the accuracy of all expense and burden accounts; secondly, because they so greatly simplify the work of cost procedure through the checks which they afford.

A brief statement of the progress through the control accounts may be valuable at this time. All obligations assumed by the company, such as raw materials, supplies, labor, and all other plant items, pass through the voucher register and are charged to some originating control account—a material account, a pay-roll account, or a charge direct to some expense account.

The object of the controls is to insure the accounting for all moneys paid out. Material purchases to go into stock, subject to requisitions, are charged to the material accounts. This material goes into a stockroom and cannot be issued

until a requisition is received for it. The requisitions are credited to the material accounts at the end of the month, and debited to the control accounts affected by the charges made on the requisitions. Direct material which enters a product is charged to Work in Process Material accounts. Material used on expense orders is charged to the control accounts representing the expense or burden receiving the benefit.

Labor is originally charged, when paid out, to the pay-roll account. How this labor is used is shown on the time cards, and at the end of the month the labor is credited to the pay-roll account, and debited to the control account which receives the benefit. Labor on direct orders is charged to a Work in Process Labor account. If the labor is expended on an expense account order, or an operating burden account, it is charged to the control account affected.

Materials, services, or other purchases directly for the benefit of an expense or burden account, are charged directly to such control account from the voucher register through the intermediate account called an "Expense Ledger" account. This last is nothing more or less than a vehicle account to assist in the transfer to the proper expense account.

The control accounts representing expenses such as Electric Power, Trucking, etc., are themselves closed out at the end of the month and journalized to the burden accounts which receive the benefit of the expense.

Burden at standard rates is then credited to the various operating burden accounts, and charged to the Work in Process Burden accounts in ratio to the number of direct-labor hours or direct-labor cost represented by the work performed during the month.

The direct material, direct labor, and work in process burden now rests in the control accounts as representing the value of the material in process; and is further represented in the files by the requisitions and time cards.

When a productive order is completed, these three accounts are credited, and the cost of the order represented by the one figure is then charged to the control account of finished stock or of cost of sales.

In considering the progress of data through control accounts as explained above, and in all the following chapters which deal with technical procedure, constant reference should be made to the chart entitled "Graphic Illustration of Flow of Cost Procedure," which accompanies this volume and which is ~~not~~ bound in the book for the express purpose of permitting the chart to be spread out for constant reference at all times. Students of cost accounting will find that one of the greatest difficulties is consistently to visualize the flow of procedure and this chart will materially aid in a full understanding of the text if it is constantly used in connection therewith.

## CHAPTER V

### MECHANISM OF COST CONTROL

#### **Need of Mechanism**

After a knowledge of cost components and the methods of controlling cost records has been gained, it is next necessary to consider briefly the mechanism of securing correct data and figures which represent those components and which go to make up the controlling accounts. As an outline of this important subject requires considerable space, this chapter is designed as an index to subsequent chapters in which detailed explanations are given.

#### **Orders**

The first requisite for adequate cost records is the control of all movements and transactions through the medium of orders. These may be classified into four main classes:

1. Purchase orders, controlling incoming materials or service. (See Chapter VIII.)
2. Production orders, controlling what is to be made and how, and the medium for direct costs. (See Chapter VII.)
3. Standing expense orders, controlling all indirect costs. (See Chapter VII.)
4. Sales or shipping orders, controlling outgoing movements of goods. (See Chapter VII.)

#### **Voucher Payable Register or Purchase Journal**

At this point it is best to bring out the fact that the voucher payable register, or purchase journal as it is often called (see



Form 1), is probably the most important pivotal record in the accounting system—no matter how deeply the methods run into cost-figuring. It is through this record that the initial distribution of all expenditures should be made. By so doing, the necessity of providing general distribution facilities is removed from all other books of entry, and the function of distribution to proper control accounts is centered in the one record.

Moreover, when one distributing record is used, efforts to make it as efficient a medium as possible can be concentrated upon it; and when the rule is strictly enforced that all expenditures must be vouchered—as should be the case—the fact that a positive channel of distribution exists is perfectly well known.

In small plants this distribution may be accomplished by columnar methods alone; but in the majority of plants it will be found best to condense the book to a few columns, to code the control accounts, and to enter the vouchers in accordance with a method of temporary class control. A detailed analysis of each class should be compiled on a separate analysis sheet. Charges to each individual account can be ascertained for posting purposes at the end of the month from this analysis sheet.

The advantages of this method of entering and distributing vouchers or purchases are:

1. Accuracy. Wide columnar books are very difficult to handle and the danger of entering data in wrong columns is great. Not even the so-called "slip-leaf books" obviate this possibility.

2. Economy. By the method shown, the greatest possible use is made of the stationery investment consistent with necessary control of work.

3. Speed. While this method may at first appear to entail more labor than the columnar method the fact has been clearly



demonstrated that it is actually faster than the method of locating the one little spot to enter the distribution on a voucher register with numerous columns.

### Distribution Columns of the Voucher Register

The distribution columns of the debit side of the voucher register (Form 1) are listed below.

*Materials and Supplies.* All charges to control accounts of materials and supplies which go into stock, subject to withdrawal by requisitions, are entered in this column. Entries are analyzed and recorded on the analysis sheet.

*Pay-Roll.* This column provides for all entries of pay-roll. Each department must have its own pay-roll account for proper control of the cost figures, as explained in Chapter XVI. This is later analyzed by departments.

*Expense Ledger Charges.* All entries of charges to standing expense orders are recorded here. No special analysis is necessary, as these charges are cared for by the use of the expense debit slips (Form 2).

HOLDEN MANUFACTURING COMPANY	
EXPENSE DEBIT SLIP	
Date .....	
Charge .....	
Description of Charge .....	
.....	
.....	
Date of Invoice .....	
Voucher Payable No. ....	
Issued by .....	Amount .....

Form 2. Expense Debit Slip. (Size, 6 x 4.)

*Freight Out on Sales.* Freight charges paid for the delivery of goods sold are entered in this column. Charges are analyzed by sales accounts. (See also Chapter IX.)

*Freight to be Deducted.* Entries of freight paid on incoming goods when purchase terms are "delivered buyer's works," are recorded here and are analyzed in accordance with the methods explained in Chapter IX.

*Freight to be Added.* This column provides for entries of freight paid on goods sold when the charge is to be added to the invoice for the goods. For details of handling see Chapter IX.

*Miscellaneous.* Charges which cannot be entered under other headings are recorded in this column. A great many items, while important, appear very seldom, such as Insurance, Taxes, Telephone and Telegraph Bills, Water, Gas, Power, etc. All these are posted directly to the control account specified.

Under each control column on the voucher register there are two items of information called for—the code number and the amount to be charged. Every control account should, therefore, be assigned a code symbol for the purpose of distribution. The symbols should be in numerical code so that they can be used in connection with electric tabulating machines whenever the occasion demands. Even a small business should always code and plan all points so that future growth will not necessitate many changes thus hindering and interrupting routine.

### **Analysis of Voucher Register**

The following columns of the voucher register (Form 1) require analysis.

*Materials and Supplies.* The analysis is recorded in a column on the analysis sheet for each material or supply account, such as Pig Iron, Sand, Coal, Bar Iron, Blank Stock,

Trimmings, Fabrics, Crude Rubber, General Stores, Store No. 1, or any other control account desired; each with its code number.

*Pay-Roll.* A column is provided for each pay-roll account. In a foundry, for instance, examples of these accounts might be Melting Department, Moulding Department, Core Department, Finishing Department, and General Pay-Roll. Each has its own designating number.

*Freight Out on Sales.* A column is reserved for each sales division when it is desirable or possible to get a distribution of the delivery freight. This may be by products, such as Complete Machine Sales, Repair Part Sales, or a more detailed distribution, as, in a lace curtain plant, Window Curtains, Bed Sets, Panels, etc. Each sales account has its own number.

### **Closing the Voucher Register**

At the end of the month the most satisfactory method of closing the voucher register operated as outlined above is as follows: Each analysis sheet should be closed up and proved to balance with the class control total in the voucher register. Then a compound journal entry should be prepared and entered in the distribution journal as follows:

#### **Debits:**

Material and Supplies Accounts. All the accounts shown on the analysis under this heading should be debited. The actual names of accounts should be shown.

Expense Ledger Account. The amount to be debited should be the total of the control column. This account is credited as described in Chapter XIX.

Department (No. ....) Pay-Roll Account. All accounts of this nature should be debited and the actual name of each shown.

(Name of Sales Account) Freight Out on Sales. Each sales account of this nature should be debited.

Freight to be Deducted. The total of the column in the analysis under this heading should be posted to this account.

Freight to be Added. The amount with which the account should be debited is the total of the analysis column under this heading.

Miscellaneous. The total of the miscellaneous column should be shown in this entry, but all postings should be made direct from the entries in the voucher register.

**Credit:**

Vouchers Payable Account. This account should be credited with the total of all vouchers shown in the control column.

**Importance of the Voucher Register**

Too much stress cannot be laid on the importance of the voucher register, inasmuch as it is the start of the scheme of controlling all features of cost accounting procedure. Through this medium is obtained the first distribution to the control accounts—where the values lie until used and passed on to some other control account. This, therefore, is the start, and the whole structure of control depends on the intelligence, care, and accuracy displayed in the distributions to the various accounts, as just explained.

**Expense Ledger Account**

In all attempts to tie up cost procedure thoroughly, the disposition of intangible items of expense which are non-receivable, has continually led to confusion and error. Examples of "non-receivable" items are charges for repairs by

outsiders, charges for all outside service, and charges for special repair materials never regularly carried in stock.

Some illustrations will make this clear. For instance, a gas engine breaks down, and a specialist is called from outside to repair it. He sends his bill. Nothing is received in the receiving room, nothing goes into stock, and no "inventory" account can be charged with this item to be requisitioned, which means that there is nothing to enter on a stock record. Again, an accident happens to a machine tool and a part is broken which is never carried in stock as a repair part. The part is ordered by express for this particular case, and on receipt is immediately snatched by the master mechanic and rushed to the machine. When these parts are charged to stores, experience has shown that in about 50% of all cases no requisition is made out. The part will be carried on the stock ledger until a check up discloses the fact that it is missing, and then it will become a part of an "adjustment."

### **Requisitioning Non-Receiveable Items**

Hundreds of such illustrations could be given to bring out the reason for the rule that—

When any material or service is known at the time of making out the request for purchase to be for a special use in connection with a standing expense order and is not and is not likely ever to be a stock matter, subject to requisition, the request for purchase shall show the standing order number to be charged with the material or service; the purchase order shall show its charge, as "Expense Ledger Account—Standing Order No. . . ."

When the non-receivable item is material—not service—the receiving clerk shall certify as to receipt as usual, and secure the receipt of the department to which destined. This closes the transaction so far as the plant is concerned. When service is rendered, the office must get the proper plant au-

thority to certify that the service was satisfactory. Nothing more is required of the plant.

The invoice is then vouchered. The entry of the vouchers charged to Expense Ledger account is made in the column of this name. The standing expense order shown in the charge is entered in the code column under the same general heading. Then, either in lots or by individual vouchers entered under this heading, an expense debit slip is made out giving all the information called for on the form. It must be made sure, through checking back, that the entries absolutely agree with the entries in the voucher register.

### **Advantages of this Method**

Note the result of this method. As a matter of fact, the Expense Ledger account becomes a sort of reservoir for "intangible charges." The expense debit slip acts as a requisition for them, and affords a means of charging the various standing expense orders. In fact, the expense debit slip is exactly the same size as a requisition, and is filed with the requisitions as if it were one.

The great advantages of this method are:

1. Absolute accuracy—nothing can get away.
2. Saving of confusion—such items are always the most difficult to handle.
3. Economy of clerical labor—the method makes a clear course to follow, and no indecision, "chasing up," or check ups are necessary.

### **Forms for Handling Details of Control**

Having discussed the method of control accounts, we will now consider the forms necessary to handle the details to maintain the controls. It is always best to have as few forms and records as possible, but some of them are absolutely necessary and certain cases call for more forms and records than others.

### Forms of Original Control

The first step is that of procurement—receiving and accounting for incoming items. The forms used are as follows:

1. *Request for Purchases.* On this form some authority requests the purchasing department to purchase goods or services. This slip should show the charge to be made. (See Chapter VIII.)

2. *Purchase Order.* This is the order sent to the vendor for goods or services. This order should show what account is to be charged. (See Chapter VIII.)

3. *Receiving Record.* Receipt of material is certified on this slip. (See Chapter VIII.)

4. *Receipt of Material Record.* This record is to bring together on the copy of the purchase order all data as to actual receipts of material, invoices received, freights, etc. (See Chapter VIII.)

5. *Purchasing Department Shipping Order.* This is an order for the use of the purchasing department to facilitate the returning of rejected material. (See Chapter VIII.)

6. *Purchasing Department Debit and Credit Memos.* These forms are to get into action a quick record of what may be shipped back on the purchase order, or any adjustments which are necessary to be made. (See Chapter VIII.)

7. *Record of Purchases.* This is a record of prices and sources of supply kept for the convenience of the purchasing department. (See Chapter VIII.)

8. *Invoice Stamp.* The data called for by this stamp should be entered on each invoice in order that all terms and freight in connection with the material can be entered intelligently. (See Chapters VIII and IX.)

9. *Voucher.* This is the enclosure form (see Form 3) for all invoices and shows data as to distribution, approvals, etc. This form is of vital importance.





10. *Voucher Register.* Vouchers are entered in this book for permanent record and for accumulating the distribution data.

11. *Stock Record.* This subsidiary analytical record of material control accounts shows quantities and values of all transactions in connection with each individual item of stock. (See Chapter X.)

### Forms Used to Record the Flow of Material

After incoming materials are entered on stock records, a great deal of care is necessary to keep track of them, owing to the varied nature of their movements. To facilitate a strict accounting, the following forms have been devised:

1. *Material Requisitions.* Stock requisitions are made out on this form. Either a production or a standing expense order is charged. (See Chapter X.)

2. *Material Credit Slip.* When excess or unused material is returned to stock the slip is filled out so that the account to which the original requisition was charged may be credited. (See Chapter X.)

3. *Scrap Tickets.* This ticket is used to account for spoiled or otherwise useless material. (See Chapter X.)

4. *Inspector's Report.* The inspector certifies as to quality and quantity of materials on this form.

5. *Identification and Move Card.* The routing of materials through the various operations is indicated on this card which accompanies the material through the various processes. (See Chapter VII.)

6. *Salvage Tag.* Tags are used to identify defective pieces and to specify the work required to salvage. The standing order to be charged should also be given.

7. *Forwarding Slip.* All lots of goods when sent by one department to another—or to stores—should be accompanied by a forwarding slip. (See Chapter XXIV.)

8. *Expense Debit Slip.* Direct charges to standing expense orders are entered upon the slip, as explained earlier in this chapter.

9. *Inventory Tags for Physical Inventories.* One of these tags is for material and supplies, and one for work in process, and are used in the taking of actual physical inventories. (See Chapter XIV.)

10. *Inventory Sheets for Physical Inventories.* One of these sheets is for material, supplies, and finished stock, and another is for work in process. These sheets are used for the recording of information from the inventory tags. (See Chapter XIV.)

### Forms Used in Accounting for Labor

All the forms used in accounting for labor are listed and briefly described below. In Chapters XV and XVI full explanation of these forms and their application to other cost records is given.

1. *In-and-Out Clock Card.* A card is assigned each employee in order that he may record his own going and coming. (See Chapter XV.)

2. *Time Cards.* On these cards are recorded the employee's time against the specific work performed. (See Chapter XV.)

3. *Pay-Roll Sheet.* Labor costs are entered on this record from time cards. (See Chapter XVI.)

4. *Overtime Report.* This is used for the daily recording of overtime. (See Chapter XV.)

5. *Late and Absent Report.* This form is used for the recording of tardiness or absence of employees. (See Chapter XV.)

6. *Labor Transfer Record.* Temporary loans of employees by one department to another are accounted for on this record. (See Chapter XVI.)

7. *O. D. S. O. Transfer Record.* To be used for the transfers of work done by one department for another. (See Chapter XVI.)

### **Accumulations for Journal Entries**

Transfers between control accounts are effected by means of journal entries. Figures to be entered come from various sources—some from actual record sheets, and some from special accumulation sheets. The order in which reference is made below to the various accumulation sheets is the normal order in which they would be considered by the cost accountant in actual practice. In the following tabulation, the special accumulation sheets from which the figures for journal entries are obtained are listed before the direct cost sheets.

1. *Inventory Accounts—Credits.* Before requisitions on stockrooms are filed under their proper order numbers, they are sorted daily into the various accounts to be credited. These totals are entered on an accumulation sheet. Monthly totals provide the figures for the journal entry. (See Chapter XIX.)

2. *Work in Process Material Accounts—Debits.* In the same way, before filing the requisitions those which are charged to production orders are sorted according to the departments as called for by the controls, and the total for the day charged to each is entered on this accumulation sheet. The total for the month provides the figures for the journal entry. (See Chapter XIX.)

3. *Burden and Expense Accounts—Material Debits.* Similarly as with Work in Process Material accounts, the remaining requisitions should be sorted according to controls of the expense and burden accounts, added and entered daily on an accumulation sheet. These figures will complete the debit side of the material distribution journal entry. All requisitions will be filed under their proper order numbers. (See Chapter XIX.)

4. *Expense Debit Slips—Accumulation of.* The expense debit slips will be sorted daily by the controls of all expense and burden accounts. The total for each control will be entered on an accumulation sheet to run for a month. This can be proved daily with the total of the expense ledger column in the voucher register, and at the close of the month will give the figures for the journal entry crediting out the entire Expense Ledger account and debiting the various expense and burden accounts. (See Chapter XIX.)

5. *Accumulation of Material Credit Slips.* The procedure as specified for requisitions is simply reversed in caring for the material credit slips. (See Chapter XIX.)

6. *Accumulation of Scrap Tickets.* An accumulation sheet is necessary for caring for scrap tickets. Because of the varying accounts affected, it is usually best to have a columnar sheet with blank headings, where the debit and credit headings can be written in.

7. *Journal Entries.* The detail treatment of journal entries will be found in Chapters XIX and XX.

### Direct Cost Sheets

Upon completion of production orders, or upon completion of runs, schedules, or months, the following cost sheets are necessary:

1. *For Individual Parts.* This cost sheet should show all the operations, losses by operation, and the burden by operations, as well as material and labor costs. (See Chapter XXIV.)

2. *For Assembled Units.* This cost sheet differs from the individual part sheet because labor operations are few, whereas material items are many. (See Chapter XXIV.)

3. *For Specific Processes.* Cost sheets for processes vary almost in proportion to the number of processes, as in most cases it is necessary to specify many divisions. They are

entirely different, moreover, from those noted under points 1 and 2 above. (See Chapter XXIV.)

4. *For Operations.* This sheet is somewhat like the process sheets, but far simpler, as it usually deals with one kind of direct labor on one kind of operation. (See Chapter XXIV.)

5. *Comparative Cost Sheets.* While not entering into the financial cycle, the comparative cost sheets are of the greatest value in cost procedure from the standpoint of actual beneficial use. (See Chapter XXIV.)

6. *Production and Cost Record.* This is a form for process costs. (See Chapter XXIV.)

### Monthly Statements

The great object of cost procedure is, of course, to get costs; but to use these costs to real advantage they must be presented properly. Therefore, the monthly statements must be accurate, on time, and well presented.

Overhead is divided into two clear divisions:

1. *Expense Accounts.* Certain expenses are collected in this account, and at the close of the month are distributed to the operating burden accounts through which they enter the cost of the product.

2. *Burden Accounts.* These are the real indirect cost accounts. Detailed indirect costs are entered on production cost sheets on a standard burden rate basis. (See Chapter XXI.)

Both of these classes of accounts must be included in monthly statements. The principal monthly statements follow:

1. *Statements of Expense Accounts.* These are collecting accounts which are distributed to the burden accounts according to the use which each department makes of the expense item controlled, such as Electric Power, Steam, etc. (See Chapter XXI.)

2. *Statement of Burdens.* A separate statement of its actual burden and cost to date for the year is prepared for each department. This statement should show the credit for applied burden at the standard rate. (See Chapters XXI and XXII.)

3. *Expense and Burden Account Collating Sheet.* This is to be used as a figuring sheet in assembling expense and burden statements. (See Chapter XXI.)

4. *Statement of Profit and Loss.* This shows the results for the month. (See Chapter XXII.)

5. *Various Schedules Subsidiary to Main Profit and Loss Statement.* Sales analysis including sales, freight out on sales, and sales cost for each classification, when too voluminous for the regular profit and loss statement, and the recapitulation of over- and under-absorbed burden balances, when too detailed for regular profit and loss statement, should be entered on subsidiary schedules.

6. *Balance Sheet.* This shows the financial status of the business at the close of the month under consideration. (See Chapter XXII.)

7. *Various Schedules Subsidiary to Balance Sheet.* Inventories, real estate accounts, bills receivable, bills payable, sundry general ledger accounts both receivable and payable, detailed analysis of surplus accounts, and many other details are best shown on special schedule statements keyed to the figures to be explained. (See Chapter XXII.)

## CHAPTER VI

### DEPARTMENTALIZATION

#### **The Need of Departmentalization**

An industrial plant must be organized properly in order to operate well. That involves intelligent departmentalization. For successful operation it is sometimes necessary to provide not only for main departments but also for minor or subsidiary departments. Intelligent departmentalization is also an indispensable prerequisite to the successful application of a cost system.

In fact, organization, management, and cost accounting are so intimately related that it is almost impossible to divorce them. However, the subject of departmentalization is treated in this chapter mainly from the point of view of the cost accountant. It might also be said that in this chapter as well as throughout the book the principles and practice of cost accounting are discussed from the standpoint of a going concern, unless otherwise stated.

If at the beginning of an engagement the cost accountant finds that the concern is not properly departmentalized for his needs, he must see to it that the organization is rearranged or he cannot do his own work satisfactorily. Therefore, the successful cost accountant must be familiar with the principles and practice of management in a good organization, as well as the principles and practice of cost accounting, and—what is probably even more important—he must know how to correlate or tie up cost accounting with management.

As the cost accountant works with the factory executives in deciding what is the most effective way of grouping de-

partners from the viewpoint both of management and of cost accounting, he begins to visualize in a general way the kind of records necessary to reflect the costs of the material, labor, and burden as they are applied to each individual department.

For example, the character of departments influences in large measure the selection of a suitable cost system. If the processes in the department are continuous, then a process system will no doubt be the most satisfactory. If the product, however, moves through the factory in well-defined lots, its cost will be best recorded under a job cost system. Both process and job cost systems may be operated concurrently in a plant where conditions such as those just mentioned are present. The details of whatever system is adopted, may be worked out later.

### **Matters to be Considered in Departmentalization**

The factors to be considered in departmentalizing a concern are as follows:

1. Assignment of responsibility.
2. Nature of operations:
  - (a) With respect to physical movements.
  - (b) With respect to costing.
3. Location of operations.

### **Assignment of Responsibility**

The assignment of definite responsibility is absolutely necessary from the point of view alike of the management and of the cost accountant. The definite assignment of physical and financial responsibility constitutes indeed the essential conception of departmentalization. Coupled with the assignment of definite responsibility is the necessity of providing the means of reflecting the results of this responsibility in figures.



### Nature of Operations

The second important factor to consider after the assignment of responsibility is the nature of the operations for which each department head is responsible. In many cases it is necessary to unite, under one responsible head, two departments which have dissimilar operations. A case in point is a small machine-shop which manufactures special machine tools with a force of fifty mechanics. Assume that forty of this number work on individual parts with machine tools, that the other ten do bench and assembly work, and that one foreman supervises the work of the entire number. In this case the two branches of work in the shop must be treated as two departments, in order to gauge results properly and to obtain accurate costs.

An additional reason for this division of work exists in this particular case inasmuch as the plant sells two products: individual parts for repairs, and assembled units. The manufacturing cost per hour for the individual parts is far greater than the manufacturing cost per hour for the assemblies, because the depreciation, the power cost of operating machine tools, the maintenance cost of equipment, etc., are higher for individual parts than for assemblies. Since as a matter of fact these items do not constitute a part of the assembly burden, the assembly burden is a comparatively low figure per hour. Under a single rate of overhead, proper costs could not be obtained for either individual parts or assemblies. As a result, losses would be suffered on sales of repair parts because of insufficient selling prices based on excessive costs. Thus a firm using the single overhead rate would be doubly unfortunate because one of the essential objects of a business of this nature is to sell as many machine units as possible in order to secure the repair part business which naturally follows. This point will be very quickly recognized by those who are constantly dealing with the problem of balanced sales.

### **Location of Operations**

The location of operations is the third important factor to consider in departmentalization. Heavy work may be done on the lower floors of the factory and lighter work on the upper floors. For certain operations more light is required than for others. Operations of a like character may be grouped, although this is not always done. The factor of location of operations is influenced very materially both by the assignment of responsibility and by the nature of operations.

In the case of two similar departments—such as two machine-shops or two assembly departments—which are in separate locations, even though one person is actually responsible for both of them, the mere fact of similarity should be no justification for combining either the two machine-shops or the two assembly departments into a single department. A similar department in a separate location should be treated as a separate department.

### **Subsidiary Departmentalization**

Reference has been made to the fact that it is frequently necessary to provide for subsidiary or minor departments as well as for main departments. These minor departments are sometimes called cost centers. For example, the process of hardening certain parts may not warrant the maintenance of a whole department for hardening alone. In this case a minor departmentalization is effected in order properly to collect and distribute the cost to the parts. Another case of minor or subsidiary departmentalization occurs in a small foundry where one foreman is in charge of all operations. In this case, if proper costs are to be kept, it is necessary to have the following minor departments: melting, core-making, moulding, finishing, and pattern. In all cases, however, a great deal of thought and planning is necessary to arrange the most efficient divisions to produce the necessary results.

### **Classes of Departments**

Regardless of the nature of the factory, its departments may be divided into two main classes: producing and service. To a limited extent, however, producing departments may perform service, and service departments may produce.

### **Producing Departments**

Producing departments are those which actually make the individual parts or assemblies which compose the finished products.

In a writing-paper factory, for example, the productive departments are the rag, machine, and finishing departments. The rag department prepares and handles materials consumed in the manufacture of "half-stock" and delivers it to the drainers. In the machine departments are carried on the processes of beating, delivery to stuff chests and refining engines, pumping to paper machines, machining, cutting, sizing, delivery to either supercalender or loft, and drying. The finishing department performs the various finishing processes which begin at the supercalender, or if material is loft-dried the processes begin with taking down the paper after it is jogged and delivering it either to the stockroom or the shipping-room. The separation of producing functions into departments must be made in order that burden and other costs may be properly distributed.

### **Service Departments**

Service departments are those which are not directly engaged in the manufacture of the product, but which render services for the benefit of the productive departments. The expenses of service departments are closed into the productive departmental burden accounts so that they may be applied to cost units—jobs, departments, or processes—whatever the unit may be.

Examples of service departments are stores, tool and machine maintenance, power and transmission maintenance, process inspection, final inspection, and shipping departments.

### **Departments Partly for Production and Partly for Service**

The work of some departments is of a hybrid character, partly for production, and partly for service. For example, the tool design department may manufacture tools for individual parts on a job, which are chargeable thereto, or it may make small tools which are serviceable for a variety of jobs, the cost of the tools being treated as a part of the manufacturing burden. Other examples of departments whose work is partly productive and partly of a service character are the blacksmith shop, the machine repair shop, and the pattern department. The cost of such departments, like those of service departments, are closed into the departmental burden accounts kept for productive departments. (See Chapter XVII.)

Inasmuch as burden cannot be controlled like direct labor and material by production control records, the importance of ascertaining correct departmental burden rates is evident. The department is the only unit which affords the proper basis for the calculation and application of such rates. (See Chapter XVII.)

### **Planning a Cost System**

After the departments have been organized in a new concern, or rearranged in a going concern, greater attention can be given to the details of the cost system. The kind of original and detailed records as well as summary records must be kept in mind. In other words, the use to be made of cost figures summarized in reports, returns, and statements for foremen, managers, and executives should never be lost sight of in devising detailed records, as probably the managerial use is their most important feature.

One important step in planning the system of accounts is to recognize and control the manufacturing branches of the plant on the one hand and the selling and administrative branches on the other. There may be, of course, only one selling and administrative unit for the entire organization, or there may be separate units for each division.

### **Secret of Correct Costing**

One of the most important elements in accurate cost-keeping is to charge as many items as possible to their final resting place in the accounts. In a well-regulated cost system, therefore, as many items as possible should be charged directly to productive or standing orders of productive departments. Items such as division expense, division labor, general expense, steam expense, electric power expense, compressed air expense, and trucking expenses, are entered first in collecting accounts for the above items. Then these accounts are distributed to expense accounts and departmental burden accounts, and later applied to cost units.

If a concern has been departmentalized along the lines that have been explained in this chapter, a sound foundation is provided on which to erect the superstructure of a cost system, for the various departments so organized afford a convenient basis for the assembling of cost data. In fact, one of the most important advantages in departmentalization is that a basis is thereby provided for the calculation and application of departmental burden rates. (See Chapter XVII.)

## CHAPTER VII

### ORDERS AND SYMBOLS

#### **Function of a System of Orders**

After an industrial plant has been so departmentalized as to manufacture the various classes of product most economically, the means must be provided for starting and controlling the factory mechanism. Since the modern factory is an intricate and sensitive mechanism, it will not work with a minimum of friction unless it is in first-class running condition and its activities are properly co-ordinated. A factory, however, even though fully equipped and supplied with necessary quantities of material and an adequate labor force, is by itself inert. Its inertia is overcome by a system of orders, which constitute the driving and regulating force. They call forth activities and also furnish the means of registering and controlling activities. No productive work should be undertaken unless authorized by a production order. Furthermore, no expense should be incurred without a warrant in the form of a prescribed and authorized order.

#### **Insufficiency of Oral Orders**

Oral orders should be eliminated because they produce mistakes, delays, and an irregular flow of production. Furthermore, oral orders more than any other factor are responsible for the prevalence in industry of the great American game of "passing the buck." The greatest disadvantage of oral orders, however, is the lack of a systematized basis for the collection of data necessary to the preparation of cost reports for executives, managers, and foremen. The factory management has no assurance that oral orders will be carried

out. If any oral orders are issued, they should be regarded as "advance notices," and should be confirmed later by written orders. It is a matter of astonishment that many factory managers do not even yet realize the inadequacy of oral orders.

### **Advantages of Written Orders**

A system of written orders makes possible a satisfactory classification of work. Moreover, a job can be easily traced from the time raw material is ordered until the finished product is on the railroad tracks ready for shipment, if its progress is governed by written orders of one kind or another. If, on the other hand, jobs passing through the plant are not accompanied by written orders, and if a production control record is not maintained, considerable time is lost in tracing and locating the product. The most important advantage of written orders, however, is that they serve as a basis for cost reports. Consequently, cost components can be compared and the efficiency of different departments can be measured.

### **Classes of Orders**

The written orders of an industrial plant are divided into four main classes:

1. Purchase orders
2. Production orders
3. Standing expense orders
4. Shipping and sales orders

*Purchase Orders.* Purchase orders are so generally understood that no reference need be made to them here. (See Chapter VIII.)

*Production Orders.* The main interest in this chapter centers in those orders which authorize production and expenses, because they provide the means of regulating costs—both direct and indirect. All notifications for the actual manufac-

ture of parts, subassemblies, and final assemblies, are made on production orders (see Form 4). These orders must state clearly just what is to be made, the number to be made, the necessary specifications, blue-prints, etc., to govern the manufacture of the product specified.

HOLDEN MANUFACTURING CO. BOSTON, MASS.																																																															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31																																	
DATE ISSUED				APPLICATION				DESCRIPTIVE NAME OF UNIT														QUANTITY				ORDER																																					
Requirements Date Quantity		Schedules Date Quantity		ACTUAL DELIVERIES Date Quantity Totals Less				RAW MATERIAL		SMALL TOOLS																																																					
										As on Hand?	As on Hand?																																																				
										When?	When?																																																				
										From	From																																																				
										Receipts	Receipts																																																				
SCHEDULES				IDENT. CARD				MAY'L REQ'N				TIME REPORTS																																																			

Form 4. (a) Production order (face). (Size, 6 x 4.)

One rule to observe in connection with production orders is to have only one item on one order. In other words, one order should cover one run of one item only. This rule is absolutely necessary in order to be able to control positively all production, both as to physical movements and costs. Partly for this reason shipping orders can never be safely used as production orders in a manufacturing plant, because in the great majority of cases the shipping order calls for goods which require from one to many production orders to make.

Production orders should only authorize the manufacture



of work. They should not be combined with cost sheets. Costs should appear on separate records known as cost sheets, which show, however, the number of the production order to which they apply.

PROGRESS RECORD																			
NO.	OPERATION	MACH.	STD. PROD.	HOURS WORK	HOURS WORK EACH SPACE = 1 HOUR														
1																			
2																			
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Form 4. (b) Production Order (reverse)

In a large plant, production orders are prepared by the production order department of the general superintendent's office or some other department, according to the nature of the organization. The number of copies filled out varies according to the type of business and the internal organization of the business.

Form 5 is an identification and move card. This card may be considered as an adjunct of the production order, in that each lot of material should be accompanied by one of these tags which specifies the order number and the sequence of operations through which the material is to pass.

The headings on the tag are self-explanatory. A word might be said, however, concerning the importance of this tag. Since it indicates the proper sequence of orders, guar-

[illegible]

**Form 5. Identification and Move Card.**  
(Size, 3 x 5.)

antees the identity of the material, and shows the proper order number to be entered on the time cards, the tag is the means by which the cost records are safeguarded.

***Standing Expense Orders.*** The indirect costs of maintaining the organization, such as the costs of executive offices and the so-called "service" departments, are chargeable to a set of orders known as service or standing orders. Examples of service departments in the clerical and administrative part of the organization are the purchasing, pay-roll, cost, statistical, filing, stenographic, billing, credits and collections, general accounting, and general office departments. In the plant the expenses of trucking, steam, dining-rooms, as well as the regular burden costs of each productive department, are also charged to standing expense orders. As a matter of fact, the term "service department" is broad enough to apply to all indirect departments in a plant.

The reason for calling the class of orders under discussion standing expense orders, is their high degree of permanence; that is, they stand from month to month. Through them the indirect costs are controlled. To use them best they should be so assigned that the various important items which make up the detailed departmental burden and expense accounts are clearly shown month by month. This makes possible an analysis whereby the person responsible for the department may be able to regulate its costs intelligently.

The number of items charged to service or standing orders should be as small as possible, not because the service should be cut to the point of inadequacy, but for the sake of reducing the indirect charges. All such costs are indirect in nature and hence must be distributed over productive work. Whenever practicable, costs should be charged directly against orders for productive work. Greater accuracy is obtainable by that method than through the distribution of expenses.

***Shipping and Sales Orders.*** The fourth class of orders—shipping and sales—are so frequently used in general accounting that their description here is unnecessary. They should, however, be adequately provided for.

**Costs Chargeable to Production and Expense Orders**

All costs are charged either to the second or to the third class of orders, namely, production or expense orders. Direct costs are chargeable to production orders; indirect costs to expense orders.

To orders of both classes numbers should be assigned. To production order numbers are charged time slips and material requisitions, the former covering direct labor, and the latter direct material. Indirect costs are charged to expense orders through the medium of material requisitions, time cards, and expense debit slips. The initial costs of many purchases are charged to an expense ledger account in the voucher register. The total of this column is posted to an expense ledger account in the general ledger. At the time indirect purchases are booked in the voucher register, expense debit slips are filled out and sent immediately to the cost department, where they are filed back of standing orders to which they are chargeable when burden and expense accounts are prepared. The total of such charges should agree with the total of the expense ledger column in the voucher register.

Some expense items are chargeable direct to burden accounts. Other expense items are charged first to accounts such as Electric Power Expense, Steam Expense, Compressed Air Expense, Division Expense, and Division Labor, and are then distributed to the burden accounts according to the proportionate amounts to be allotted to each. (See Chapters XVII and XVIII.) The burden in the burden accounts is then applied to the units of production according to the method in use for handling burden.

**Charging by Means of a Code**

In the preceding paragraph the advisability of assigning numbers to both classes of orders was mentioned. In fact, for convenience in charging costs in any plant, a comprehen-

sive system or code of symbols should be worked out covering divisions, departments, orders, products, machines, tools, operations, and accounts of every kind. The completeness and convenience of this code has a great deal to do with the effective functioning of the cost system.

### **Requisites of a Code**

To be serviceable the symbols of a code must be unmistakable, easy to remember, as brief as possible, and as permanent as possible.

In a plant that is properly equipped with electric machines for its cost work, the symbol code must be a system of numbers, for no other kind of symbols will pass through the sorting and tabulating processes of these machines. Combinations of letters, numerals, periods, etc., cannot be used.

### **Advantages of a Code**

The advantages of code numbers are many. For instance:

1. They aid the memory.
2. They reduce the clerical work involved in writing up material requisitions, time tickets, expense debit slips, production orders, and standing expense orders.
3. They facilitate the mechanical sorting and tabulating of records in connection with the compilation and presentation of material, labor, and burden costs.

### **SAMPLE CODE OF ORDERS**

The following pages outline a system of code numbers in actual use for standing expense orders. It is shown, of course, as an illustration only. Obviously, a code must be prepared to fit the exigencies of each individual plant.

### How the Code Is Used

In order to charge costs to the division, department, and order to which they apply, code numbers must be assigned to each. The word "division" is simply a term applied to each separate plant of the organization. For example, the organization—the symbol code of which is here discussed—has eight separate divisions or plants.

The divisions are numbered from 1 to 8, departments from 1 to 50, standing orders from 1 to 500, etc. A combination of all three is used to indicate an order number, placing dashes between the groups. For instance, in the order number 1-21-15, the "1" represents the division, the "21" the department in that division, and the "15" the standing order chargeable to that department. To indicate an order number for a division expense, i.e., one that applies to the division as a whole and not to any specific department, a cipher is inserted after the division number, as 1-0-82. To complete an order number, three distinct numbers must be shown.

The code for the departments of division 1 is as follows:

- 1-1 Cutting Off, Dies, Reamers, and Taps
- 1-2 Automatics
- 1-3 Grind, Centering, and Squaring Taps and Reamers
- 1-4 Threading Bolts  $\frac{7}{16}$  to  $1\frac{1}{2}$ "; Pipe  $\frac{1}{8}$  to 1"
- 1-5 Stamping Taps and Reamers
- 1-6 Turning Taps
- 1-7 Fluting Taps
- 1-8 Relieving Taps and Threading Pipe Taps
- 1-9 Threading Taps  $\frac{3}{16}$ " and Smaller and Middle-Sized
- 1-10 Squaring and Fluting Small Taps
- 1-11 Grinding and Polishing Small Taps
- 1-12 Reamers
- 1-13 Milling, Drilling, and Hobbing Little Giant Dies
- 1-14 Die Blanks, Drill, Hob, Split, Burr and Casking, Light, and G. R. Dies
- 1-15 Acorn and Spring Dies
- 1-16 Special Dies
- 1-17 Stamping and Filing all Dies except Button

- 1-18 Button Dies
- 1-19 Polishing
- 1-20 Hardening Room

### **Production Order Code for Individual and Assembled Parts**

The code for productive orders for individual and assembled parts should be assigned in numerals which do not conflict in any way with the standing expense orders.

In the particular code used in this chapter for illustrative purposes, the assignments for division one are as follows :

Individual parts, 10001 up

Assembled parts, 110001 up

This gives 9999 orders for each division. The difference between the individual and assembly orders is shown by a single index figure of 1, or a double index figure of 11.

Division two would have orders of—

Individual parts, 20001 up

Assembled parts, 220001 up

and so on for all divisions up to the eighth.

### **Standing Expense Order Code**

Numbers 1 to 500 might be assigned to the plant code standing orders; and numbers 1000 to 6000 for the office expense code standing orders.

#### **1. Plant Expense Code**

All accounts under the headings "Burden Labor" and "Departmental Maintenance and Supplies" are for the expenses of the departments within a division. None of these accounts should be charged with expenses which cannot be assigned to a particular department. Any expenses the benefits of which are spread over several or all departments of the division, are Division Expenses. Division Expenses, like

other "apportioned charges," such as Electric Power Expense, Steam Expense, and Compressed Air Expense, are closed into other expense accounts, such as General Superintendent's Office, Engineering, Industrial Relations, etc., and also into departmental burden accounts.

### BURDEN LABOR

Standing order account numbers from 1 to 14 are assigned to Burden Labor as follows:

**1 FOREMEN AND ASSISTANTS**

Be careful to distinguish between departmental and divisional supervision and charge this account with departmental supervision only.

**2 INSPECTION EXPENSE**

Charge with all labor performed in inspecting the product passing through the department, except when possible to charge to productive orders.

**3 TIMEKEEPERS AND TOOL CRIB LABOR**

Charge with the time of dispatch clerks and toolroom labor.

**4 CLEANING AND SWEEPING**

Charge with all cleaning and sweeping for each department, including cleaning of machinery.

**5 OILING SHAFTING**

Self-explanatory.

**6 HANDLING PRODUCT**

Charge with all trucking and moving of material in the department.

**7 WORK ON ACCOUNT OF SHOP ERRORS**

This number is used for charges entailed in correcting defective work, irrespective of who performs same. This number will, of course, be prefixed with the proper designation of the department which produced the defective work.

**8 GENERAL LABOR**

Charge with all indirect labor which cannot be otherwise classified. Use as little as possible and specify work performed.

**9 IDLE TIME**

If a worker is idle and is being paid for it, charge his time to this account and state cause of idleness.

**10 INSTRUCTION EXPENSE**

Apprentice school only. Charge to this account all expenses incident to the apprentice school instruction.



11<sup>1</sup>

## 12 ATTENDANCE BONUS

This is departmental only.

13<sup>1</sup>14<sup>1</sup>

## DEPARTMENTAL MAINTENANCE AND SUPPLIES

Accounts under this heading may be charged with either material or labor—and the burden of other departments when one department does work for another.

## 15 MAINTENANCE OF MACHINERY

Charge this account with the maintenance of all machines, including any fixtures attached to the machines, and always give number of machine being repaired.

## 16 MAINTENANCE OF JIGS, TEMPLATES, ETC.

Self-explanatory.

## 17 MAINTENANCE OF SHAFTING, PULLEYS, AND HANGERS

Charge with the up-keep of all shafting, pulleys, and hangers within the department.

## 18 MAINTENANCE OF BELTS

Self-explanatory.

## 19 MAINTENANCE OF ELECTRICAL APPARATUS

Charge with the maintenance of motors and other electrical equipment within each department, except the maintenance of electrical furnaces, which should be charged to account 21, and general departmental electric equipment, such as power lines, etc., which should go to account 20.

## 20 MAINTENANCE OF WATER, AIR AND POWER LINES

This account covers the maintenance of equipment through which the water, air, or current used is transported. The maintenance of any equipment which does not serve some particular department is divisional expense and should be charged to accounts covering that classification.

## 21 MAINTENANCE OF FURNACES

Charge with the maintenance of all hardening and tempering furnaces in the department.

## 22 OTHER MAINTENANCE

Charge with all maintenance which cannot be otherwise classified.

---

<sup>1</sup> These numbers are reserved for accounts which may have to be added later. It will be noted that numbers have also been reserved for possible additions to other groups of standing orders.

**23 MAINTENANCE OF FIXTURES**

Charge this account with the maintenance of such items as inside factory trucks, benches, hoists, overhead tracks and trolley, general safety devices, etc.

Accounts 24 to 45 inclusive are for the purpose of classifying and recording the supplies used in each department. Owing to their non-durable nature small tools are considered as belonging to this class and are charged to an account in this group. Likewise the maintenance cost of small tools, such as the cost of sharpening drills, etc., is charged to some departmental maintenance and supplies account.

**24****25 DIES****26 HOB TAPS****27 MILLS AND DRILLS**

Charge with all mills and drills used, whether purchased or manufactured by the company. Also all labor in connection with their up-keep.

**28****29****30****31 EMERY WHEELS AND OTHER ABRASIVES**

Charge this account with all emery wheels and abrasives, also with the labor used in connection with their up-keep.

**32 LUBRICANTS AND CUTTING OILS**

Charge with all oils for lubricating and cutting purposes. Departmental only. (See account 60.)

**33 ELECTRIC LAMPS****34 GAS****35 FUEL OIL**

Charge with oil used as fuel for manufacturing purposes.

**36 OTHER FUEL**

Charge with any other fuel for manufacturing purposes.

**37 MISCELLANEOUS SHOP SUPPLIES**

Charge with all supplies used for which no special account is provided. Use as little as possible.

**38 WELDING MATERIAL**

Charge with all welding material used for any purpose.

**39 BONE, CYANIDE, QUENCHING, AND TEMPERING OILS**

This account is designed to hold all hardening supplies.

40 SODA

41

42

43

44

45

### DIVISION EXPENSE

There are certain expenses in an organization which apply to the division as a whole and not to any specific department, although these expenses must be distributed to the departments in proportion to the benefits which are derived from such expenses. Other expenses, such as those for electric power and compressed air, etc., are similarly treated.

Accounts 51 to 80 are charged with all expenses pertaining to the division in general, except division labor, electric power, steam, and air compressor expenses, for which special accounts are provided.

#### 51 SUPERINTENDENCE

Be careful to distinguish between departmental supervision and charge this account with divisional supervision only.

#### 52 OFFICE SALARIES

Charge this account with the salaries of all divisional office clerks.

#### 53 RECEIVING AND RAW MATERIAL STORES EXPENSE

Charge with all expense in connection with the receiving and storing of raw materials and supplies, such as salaries of receiving clerk, storekeeper, etc.

#### 54 SHIPPING AND FINISHED MATERIAL STORES EXPENSE

Charge with all expense in connection with the shipping and storing of finished materials.

#### 55 UNDISTRIBUTED MILLWRIGHT TIME AND EXPENSE

Whenever possible, charge the time of millwrights and other millwright expense direct to a specific department under a maintenance order number; but where that is impracticable this account is to be used.

#### 56 WATCHMEN

Charge with all watchmen's labor and other expenses incurred in watching the premises.

#### 57 ATTENDANCE BONUS

Divisional only.

**58 GENERAL MISCELLANEOUS EXPENSE**

Charge with all miscellaneous expense not chargeable to specific accounts. Use as little as possible.

**59 EXPERIMENTAL EXPENSE**

This account is to be charged with all experimental work within a division.

**60 LUBRICANTS**

Such items as oils, grease, etc., that cannot be charged to a department.

**61 OFFICE SUPPLIES**

Charge with all office supplies used by the division either in the office or in the shop.

**62 MAINTENANCE OF OFFICE EQUIPMENT**

Charge with the up-keep of all office equipment used by the division.

**63 MAINTENANCE OF BUILDINGS**

Charge this account with the up-keep of all buildings connected with the division.

**64 MAINTENANCE OF ROADS AND GROUNDS**

Charge with all expense in connection with the up-keep and improvement of roads and grounds about the division buildings.

**65 MAINTENANCE OF PATTERNS**

Charge with the maintenance of all patterns covering product manufactured by the division.

66

67

68

69

70

71

72

**73 POSTAGE**

Charge with postage used by division.

**74 UNASSIGNED TRANSPORTATION CHARGES**

Any freight or express bills which cannot be otherwise classified may be charged to this account.

75

**76 INVENTORY EXPENSE**

77

78

79

**80 DIVISIONAL DINING-ROOM AND WELFARE EXPENSE**

## STEAM EXPENSE

Numbers 81 to 90 are assigned to the various components of Steam Expense as follows:

## 81 LABOR

Charge with all firemen's labor.

## 82 MAINTENANCE OF BOILER

Any labor or other expense incurred in the up-keep of boilers should be charged to this account.

## 83 MAINTENANCE OF OTHER APPARATUS

Any labor or other expense incurred in maintaining apparatus or equipment used for steam purposes, except boilers, will be charged to this account.

84

85

## 86 COAL AND OTHER STEAMING FUEL

## 87 OTHER SUPPLIES

Any supplies used for steam purposes, except coal or other steaming fuel, are charged to this account.

88

89

90

## ELECTRIC POWER EXPENSE

Numbers 91 to 100 are used to identify charges coming under the general heading of Electric Power Expense.

## 91 CURRENT PURCHASED

## 92 LABOR

Any labor in connection with electric power which cannot be classified as maintenance.

## 93 MAINTENANCE OF TRANSFORMERS

Charge with any labor or other expense in maintaining the transformers serving the division.

## 94 MAINTENANCE OF GENERAL POWER LINES

This account is for labor and other expense in maintaining the main power lines serving the division.

## 95 MAINTENANCE OF OTHER APPARATUS

Any labor or expense incurred in maintaining apparatus which cannot be classified under other accounts.

## 96 MAINTENANCE OF WATER POWER EQUIPMENT

**97 MAINTENANCE OF GENERATORS**

All labor and other expense incurred in maintaining the generators serving the division is charged to this account.

98

99

100

**COMPRESSED AIR EXPENSE**

The various charges coming under Compressed Air Expense are assigned numbers as follows:

**101 LABOR**

Attendants, etc.

**102 MAINTENANCE OF COMPRESSORS**

Labor and expense necessary to keep compressors in repair.

**103 MAINTENANCE OF ELECTRICAL EQUIPMENT**

Labor and expense necessary to keep driving motors, etc., in repair.

**104 MAINTENANCE OF OTHER EQUIPMENT**

Labor and expense necessary to keep tanks, etc., in repair.

**105 OILS AND WASTE****106 MISCELLANEOUS SUPPLIES**

107

108

**2. Office Expense Code**

The rest of this code deals with subdivisions of the office expense code. The nature of the code depends on the size and nature of the office organization, the number of accounts, and how deeply the executives want to go into an analysis of the figures.

All salaries and every other expense connected with the departments known as "general" are to be accounted for according to the correct code number. It is very essential that all those who are concerned with either the distribution of salaries or the accounting of invoices study this code and fully understand its use.

The code for administration, selling, etc., is a standard code with the expense items numbered from 1 up to 30.

**ADMINISTRATION AND GENERAL OFFICE EXPENSE**

Each branch of the administrative and general office is designated by its individual number in the hundred column as follows:

- 1000 ADMINISTRATION
- 1100 GENERAL ACCOUNTING
- 1200 CREDITS AND COLLECTIONS
- 1300 BILLING
- 1400 STENOGRAPHIC
- 1500 GENERAL OFFICE
- 1600 STATISTICAL
- 1700 FILING

The number representing the branch of the general office to which a charge is made should always prefix the figure indicating the expense item. For instance, 1001 would represent salaries (see detailed code below) paid to persons in the administrative department.

A code for the various expense items is given below. The first eight numbers listed will combine with any one of the eight department numbers. Numbers 13 and 14 in the nature of the case can be prefixed by 1500 only, and numbers 16 to 19 by 1000 only.

- 1 SALARIES
- 2
- 3
- 4
- 5 OFFICE SUPPLIES
- 6 SUNDRIES
- 7 TELEPHONE AND TELEGRAPH
- 8 TRAVELING AND ENTERTAINMENT
- 9 POSTAGE
- 10 ATTENDANCE BONUS
- 11 ASSOCIATION DUES, ETC.
- 12 TABULATING MACHINE EXPENSE
- 13 GENERAL OFFICE GROUNDS EXPENSE

Charge all expense incurred through the up-keep of the general office grounds, such as mowing lawns, shoveling sidewalks, etc.

14 GENERAL OFFICE REPAIRS

Charge this account with all expense necessary for the up-keep of the general office equipment, buildings, etc.

15

16 LEGAL OR COLLECTION EXPENSE

17 CHARITIES

18 DIRECTORS' FEES

19 EXCHANGE

20

21

22

23

24

SELLING EXPENSE

Each branch of the selling organization is assigned a number which should precede the symbol representing the expense item to be charged. These branch numbers are as follows:

2100 GENERAL SALES OFFICE MANAGER

2200 BOSTON BRANCH

2300 ST. LOUIS BRANCH

2400 CHICAGO BRANCH

2500 SAN FRANCISCO BRANCH

The detail code for selling expense items is given below.

1 SALARIES—SALESMEN

2 SALARIES—OFFICE

3 COMMISSION

4

5 OFFICE SUPPLIES

6 SUNDRIES

7 TELEPHONE AND TELEGRAPH

8 TRAVELING AND ENTERTAINMENT

9 POSTAGE

10 ATTENDANCE BONUS

11

12 SUNDRY FREIGHT

13 RENT

14

15

16 ADVERTISING—SPACE

17 ADVERTISING—SUNDRY



- 18 CUTS AND ELECTROS, RETOUCHING AND DRAWINGS
- 19 CATALOGUES AND CIRCULARS
- 20 PHOTO SUPPLIES AND EXPENSE
- 21 EXHIBITS
- 22
- 23
- 24

### MERCHANDISE EXPENSE

When the business requires a large stock of finished product ready for shipment, a merchandise department may be maintained. The code numbers for the amounts in this department are as follows:

- 3601 SUPERINTENDENCE
- 3602 OFFICE SALARIES
- 3603 SHIPPING CLERKS AND ASSISTANTS
- 3604 LABOR
- 3605 OFFICE SUPPLIES
- 3606 SUNDRIES
- 3607 TELEPHONE AND TELEGRAPH
- 3608 INVENTORY EXPENSE
- 3609 POSTAGE
- 3610 ATTENDANCE BONUS
- 3611 REFINISHING EXPENSE

To this account charge all labor and expense caused by having salable goods refinished (polished, etc.). In other words, goods that have been in stock and which must be retouched, etc., before shipping.

- 3612 MAINTENANCE OF FIXTURES

To this account charge all labor and expense used in repairing such equipment, as racks, trucks, benches, etc., used by this division.

- 3613 CHANGES IN PRODUCT OTHER THAN AS FIRST PRODUCED

To this account charge all labor and expense involved in changing product from its originally finished condition into another shape, size, etc., always keeping and reporting exact changes made. In order to keep the stock records straight, the stock record clerk must be furnished with slips which indicate changes in the original product. Notations are made on these slips as follows: "Changed from.....To....."

- 3614 CONTAINERS

All purchases of wood boxes, cardboard boxes, envelopes, or any other containers for the product.

**3615 SHIPPING CASES**

To this account charge all labor and material used in making shipping cases, also purchases of finished boxes, box shooks, etc.

**3616 NAILS AND SCREWS****3617 SHIPPING AND PAPER****3618 EXCELSIOR****3619 LABELS****3620 MISCELLANEOUS SUPPLIES****GENERAL SUPERINTENDENT EXPENSE**

This section is designed to cover all expenses of the general superintendent's office. Most of the accounts need no explanation.

**4001 SALARIES****4002****4003****4004****4005 OFFICE SUPPLIES****4006 SUNDRIES****4007 TELEPHONE AND TELEGRAPH****4008 TRAVELING AND ENTERTAINMENT****4009****4010 ATTENDANCE BONUS****INDUSTRIAL RELATIONS EXPENSE**

The detail code of items chargeable to industrial relations standing orders is as follows:

**4100 SALARIES AND EXPENSE****4101 EMPLOYMENT SALARIES****4102 EMPLOYMENT SUPPLIES****4103 EMPLOYMENT SUNDRIES****4104 EMPLOYMENT TELEPHONE AND TELEGRAPH****4105 EMPLOYMENT TRAVELING****4106****4107****4108 SAFETY EXPENSE****4109 INDUSTRIAL INSURANCE****4110 ATTENDANCE BONUS****4111 PLANT MAGAZINE—SALARIES**

**4112 PLANT MAGAZINE—PRINTING****4113 PLANT MAGAZINE—SUNDRIES****4114 GENERAL WELFARE SUNDRIES**

To this account charge all items that have to do with welfare work and which have not otherwise been provided for.

**4115 RESTROOM EXPENSE**

To this account charge all expense arising from keeping the restrooms at the various divisions in usable condition, such as sweeping, cleaning, repairs, etc.

**4116 HOSPITAL—SALARIES****4117 HOSPITAL—MISCELLANEOUS EXPENSE****4118 SICK AND ACCIDENT EXPENSE****4119****4120 GIRLS' TRAINING EXPENSE**

This account is to cover all expenses connected with the girls' training school at plant B. All labor and supplies used in this school should be charged to this account number.

**DINING-ROOM EXPENSE**

The following numbers are used as a Dining-Room Expense code :

**4201 SALARIES AND WAGES****4202 OFFICE SUPPLIES****4203 TELEPHONE****4204****4205****4206 MAINTENANCE—DISHES****4207 MAINTENANCE—ALL OTHER EQUIPMENT****4208****4209****4210 ATTENDANCE BONUS****4211 FOOD SUPPLIES****4212 MISCELLANEOUS EXPENSE****4213****4214****TRUCKING EXPENSE**

The accounts under this heading have been designed to cover all charges in all divisions for trucking. All labor and expense should be charged to some one of these accounts.

This includes any and every self-propelled and horse-drawn vehicle owned or operated by the corporation. It also covers all charges for outside trucking.

- 4301 SUPERINTENDENCE
- 4302 LABOR—DRIVERS
- 4303 LABOR—HELPERS
- 4304 MAINTENANCE OF GASOLINE TRUCKS
- 4305 MAINTENANCE OF ELECTRIC TRUCKS
- 4306 MAINTENANCE OF PASSENGER CARS
- 4307 MAINTENANCE OF GARAGE AND EQUIPMENT
- 4308 MAINTENANCE OF HARNESES
- 4309 MAINTENANCE OF WAGONS
- 4310 ATTENDANCE BONUS
- 4311 MISCELLANEOUS SUPPLIES
- 4312 GASOLINE
- 4313 OIL
- 4314 TIRE EXPENSE
- 4315 FEED AND SHOEING
- 4316 TELEPHONE
- 4317
- 4318 OUTSIDE TRUCKING CHARGES
- 4319

#### TENEMENT EXPENSE

The code of items for Tenement Expense is not very detailed.

##### 4401 TENEMENT EXPENSE

All items of expense pertaining to tenements should be charged to this account number. Specify each property.

- 4402
- 4403

#### GENERAL STORES EXPENSE

General Stores Expense items are coded as follows:

- 4501 SALARIES
- 4502 WAGES
- 4503 MISCELLANEOUS SUPPLIES
- 4504 MAINTENANCE OF FIXTURES
- 4505
- 4506

4507 INVENTORY EXPENSE  
4508  
4509  
4510 ATTENDANCE BONUS

### ENGINEERING EXPENSE

The same principle of coding explained throughout this chapter can be applied to Engineering Expense as shown below.

4601 SALARIES  
4602  
4603  
4604  
4605 OFFICE SUPPLIES  
4606 SUNDRIES  
4607 TELEPHONE AND TELEGRAPH  
4608 TRAVELING  
4609 EXPERIMENTAL

Charge with all laboratory expense and other items of an experimental nature that do not apply to any one division.

4610 ATTENDANCE BONUS

### PERSONAL CHARGES

In order to prevent failure to charge work done in the factory for executives personally, code numbers, known as "Personal Charges," are provided, for example:

5000 A. BROWN  
5001 J. SMITH  
5002 R. ROE

## CHAPTER VIII

### PURCHASE AND RECEIVING RECORDS

#### **Importance of Purchase and Receiving Records**

Too much stress cannot be laid on the importance of the records which have to do with the request for, and the actual purchase and receiving of, new materials.

The old methods of ordering materials or services, without consideration as to the accounts to which they were to be charged, or as to the ultimate representation of their costs in the records, have been the cause of endless confusion and inaccuracy not only in the general accounting of the company, but particularly in the cost accounts. It should be distinctly known at the time when the need for any material or service arises, exactly why it is required and where it is to be charged.

An important advantage which accrues from this method is that in many cases the consideration of the ultimate disposition of the costs to be incurred prevents the spending of money for what is after all unnecessary. This applies to certain materials and extras, and to various services performed which often turn out to be unnecessary.

Obviously, all the records which have to do with purchasing and receiving have a close bearing on the business as a whole, and the mechanism instituted in these departments should be designed and operated, not only with a view to the efficiency of the departments themselves, but with full thought for the assistance which can be given to other departments.

#### **Nature of Purchases**

As there are many kinds of purchases, it is to be expected that they will originate in a number of different ways. Not

all of the obligations assumed by a manufacturing institution are by any means handled entirely by the purchasing department, although the methods of handling obligations must be the same throughout the plant in order that methods of control may be standardized.

Purchases may be grouped in the following principal classes :

1. Materials necessary to maintain the regular stocks of raw materials, supplies, and all other merchandise handled by regular stock methods.
2. Items of material which are necessary for purposes of repair, but which are not regular stock items, and which are not represented on stock records at the time of order, and are not likely ever to be.
3. Services of various nature, such as boiler and pipe line repairing, or any work of repair and maintenance which may be requisitioned from outside the organization. This would include also services by outside accountants, engineers, etc.
4. All items, such as advertising, etc., which may be arranged through the publicity division of a company as separate from the purchasing department.
5. All miscellaneous services not covered by any of the above—including telephone and telegraph service, purchased electric power, etc.

### **Mechanism of Purchasing and Receiving**

As an aid in further discussion, it is important to understand clearly the mechanism involved in the purchasing and receiving department, and particularly the various forms used and their functions and application. The principal ones are :

1. Request for purchase
2. Purchase order

3. Record of receipt of material
4. Purchasing department shipping order
5. Purchasing department debit and credit memos
6. Receiving report
7. Record of purchases
8. Distribution stamp for invoices

### 1. Request for Purchase

Form 6 shows a request for purchase. It is prepared in duplicate, each copy being in a different color. One copy is

HOLDEN MANUFACTURING CO. BOSTON, MASS.				
DATE _____		REQ. No. _____		
REQUEST FOR PURCHASE				
PLEASE FURNISH THE FOLLOWING FOR DEPT. _____		CHARGE ACT. _____		
USE _____		DEL'Y WANTED _____		
QUANTITY	DESCRIPTION	PRICE	AMOUNT	

ORDER FROM _____		ORDER NO. _____	
ADDRESS _____		DATE _____	
APPROVED _____		SIGNED _____	

Form 6. Request for Purchase. (Size, 8 x 4.)

retained in the originating department, the other being sent to the purchasing department. This form is used to notify the purchasing department of what is desired or, in case arrangements have already been made, to notify the purchasing department to issue a purchase order to cover the item.

These forms should be serially numbered and should show the department for which the material or service is desired, the use to be made of whatever is ordered, and all other essen-



tial descriptive data. The form may show also from whom the material or service is to be obtained.

There are two points of prime importance in connection with this form: (1) The request must be approved by someone in authority other than the one signing the request. (2) The requisition must show the account which is to be charged

<b>PURCHASING DEPARTMENT</b> <b>HOLDEN MANUFACTURING CO.</b> <b>BOSTON, MASS.</b> <b>GAUGES - SCREW CUTTING TOOLS - MACHINE TOOLS</b>		<b>ORDER NO.</b> <small>Order no. must appear on invoice and on every package</small> <b>INVOICE RECORD</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="padding: 2px;"><b>REQ. NO.</b></td></tr> <tr><td style="padding: 2px;"><b>M. C. TO</b></td></tr> <tr><td style="padding: 2px;"><b>DEL. TO</b></td></tr> <tr><td style="padding: 2px;"><b>ACCT. NO.</b></td></tr> </table>	<b>REQ. NO.</b>	<b>M. C. TO</b>	<b>DEL. TO</b>	<b>ACCT. NO.</b>
<b>REQ. NO.</b>						
<b>M. C. TO</b>						
<b>DEL. TO</b>						
<b>ACCT. NO.</b>						
<b>M</b>	<div style="border: 1px solid black; height: 40px; width: 100%;"></div>					
<b>GENTLEMEN:</b> Please enter our order for the following material and make shipment as instructed <b>MARK SHIPMENT</b> Via						
<div style="display: flex; justify-content: space-between;"> <div style="width: 60%;"> <p><b>DUPLICATE BILL REQUIRED <u>WITHOUT</u> PRICES</b></p> <p>Acknowledge receipt of order on enclosed card. State <b>DEFINITE</b> delivery date.</p> <p>Please mark all packages as instructed, in order to insure delivery to proper destination.</p> <p>Render invoice at lowest cash price, stating cash discount and terms of delivery.</p> <p>State how shipment has been forwarded.</p> <p>B/L must be sent with invoice. We pay no boxing or cartage charges.</p> </div> <div style="width: 35%; text-align: right;"> <p><b>HOLDEN MANUFACTURING CO.</b></p> <p>Purchasing Agent.</p> </div> </div>						

Form 7. Purchase Order. (Size, 8½ x 11.)

with the material ordered; this item is of the utmost importance, as will be shown later.

## 2. Purchase Order

The purchase order—here illustrated by Form 7—may be of almost any design, provided it shows clearly all references, such as order number, request for purchase number,

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RECORD OF MATERIALS AND INVOICES RECEIVED FOR ABOVE REQUISITION

[illegible]

Form 8. Receipt of Material Record. (Size, 13¾ x 13½.)

and all other data in connection with what the material should be and from whom it should come. As purchase orders are common, special explanation is hardly necessary. One point, however, demands strong emphasis, namely, that the accounting of the material must be shown *in every case*, and must agree with the charge shown on the request for purchase.

### 3. Receipt of Material Record

It is important to have a record of all receipts on each purchasing order which will show not only the receipts of items, but also all essential facts connected with each item, such as the date of invoice, car numbers, weights, and freight bills. This is of the utmost importance in properly handling the transportation charges, for when this master record is properly filled out, it hooks together the invoices and the freight bills. This record (Form 8) is a copy of the purchase order, and is the last carbon when a purchase order is written, the excess edges being folded under at time of writing. The sheets are filed in a multiple ring binder in sequence of purchase order numbers.

### 4. Purchasing Department Shipping Order

In many cases material is rejected upon inspection as not complying with the purchase order in the matter of quality or other points. It is therefore necessary to provide some means to authorize shipping such material back to the vendor. As the matter is entirely in the province of the purchasing department, it has been found useful to have purchasing department shipping orders, as shown in Form 9. These provide a very simple and effective method of quickly handling rejected material, while holding strictly to the rules that nothing should leave the plant without a shipping order. No special comment on the form is needed, except for the caution that here—as with all other transactions in connection with the purchasing

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**Form 9. Purchasing Department Shipping Order. (Size, 8½ x 11.)**

## 5. Purchasing Department Debit and Credit Memos

Form 10 shows a purchasing department debit memo. The credit memo is identically the same with the exception

[illegible]

**Form 10. Purchasing Department Debit Memo. (Size, 11 x 7.)**

that the main heading will read "Credit Memo" and further that all the item headings will be reversed as to their meaning, such as "Credit Memo by" in place of "Debit Memo by." These two memos are designed to speed up the work of adjustments by the purchasing department on incoming materials.

[illegible]

**Form II. Receiving Report.** (Size, 8½ x 7¼.)

cases this is of utmost importance on account of the delay of vendors in issuing credit memos—in some cases many weeks elapse before the credit memos are returned. In the meantime, however, the debit memo issued by the purchasing department is put through the records in regular form, a copy being sent to the vendor.



### **7. Record of Purchases**

It is usually best for the purchasing department to maintain a card or book record (Form 12) to show the data in connection with the purchasing of all items of sufficient importance to be recorded. Nearly every up-to-date concern maintains some record of this sort in order to furnish full knowledge of what has been done before in relation to each item and as a guide in current purchases. This form is of particular use in connection with items whose source of supply is more or less restricted and as to which it is necessary to know exactly with whom to deal in connection with the purchase.

For much of the material handled by a manufacturing institution, the stock record (Form 14, page 130) will be found of great value in connection with, or in place of, the record of purchases. This applies particularly to staple articles, such as bolts, nuts, nails, and steel, purchased from vendors whose names are not of great importance, and to all supplies which have to be drawn from many sources.

### **8. Distribution Stamp for Invoices**

Figure 13 shows a form of rubber stamp which may be used in connection with the approval and distribution of invoices.

It is especially important that all the information shown on this stamp should be given for each invoice. While the stamp is quite large, there is really nothing on it which can be dispensed with.

### **Other Forms**

There are many other forms which might be shown in connection with the discussion of the work of the purchasing department. In fact, those here shown represent the smallest number with which a purchasing department can operate accurately. It is, of course, necessary for a purchasing depart-



<b>HOLDEN MANUFACTURING CO.</b> <b>BOSTON, MASS.</b>		
PURCHASE ORDER No. _____		
TERMS _____		
FREIGHT CHARGES _____		
MATERIAL REC'D - DATE _____		
REC. REF. No. _____		
PRICES O.K. BY _____		
EXT'D O.K. BY _____		
E.T.O. {	PURCHASE ORDER BY _____	
	STOCK RECORD BY _____	
	EXP. LGR. BY _____	
<b>ACCOUNT</b>		<b>AMT.</b>

Form 13. Invoice Stamp. (Size,  $2\frac{1}{2} \times 3\frac{1}{2}$ .)

ment to maintain follow-up files for incoming material, quotation files for the various materials required, and many other detailed records which are important, but which have no direct bearing on the subject of this book.

#### ORIGIN OF PURCHASES

The origin of purchases has a close bearing on all the procedure which follows. To take up some items in detail will give an idea of how such matters should be handled.

#### Purchases of Material for Stock

In the case of the material covered by stock records, the request for purchase is made out by the stock record clerk.

Therefore, raw materials, supplies, and in some institutions certain materials purchased from the outside for use in assemblies and for direct shipment, which are in stock, should be covered by stock records.

Before making out the request for purchase, the stock record clerk carefully considers the maximum and minimum limits discussed in Chapter XIII. In addition to these factors, the requirements columns of the stock record sheet show when it is necessary to order material and the quantities needed.

The request for material must receive the approval of the general storekeeper and perhaps of some other official. It is then passed on to the purchasing department for action. The purchasing department returns a copy of the purchasing order to the stock record department, so that an entry may be made on the stock record sheet of the date of order, the purchase order number, and the quantity ordered.

Each stock record sheet should show the material inventory account which covers the material to be ordered, and the number of that account must be placed on the request for purchase.

### **Items of Material Necessary for Purposes of Repair**

In many instances purchases are made of repair parts which are never carried in stock, nor is it desirable to carry them. Such is the case, for instance, when a piece of material drops into a machine, strips the gears, and necessitates a special order for parts which under ordinary circumstances would never need replacement. In all such cases the request for purchase should originate with the master mechanic and should have the approval of the general superintendent.

A full explanation must be given on the request for purchase of the use to which the material is to be put, not only as a matter of record but also to assist the receiving department in quickly disposing of the material when it is received.

Another important point is that of settling the account to which this material will be charged. Material of this nature should not be charged to an inventory account; instead it should be charged direct to the standing expense order affected by the purchase. On each request for purchase of this nature the entry for charging the account should give the standing expense order covering repairs on the particular piece of equipment for which the material is desired. The accounting department should enter this invoice as a debit against the expense ledger account, and make out an expense debit slip chargeable to the standing order number (see Chapter V).

Too much stress cannot be laid on the importance of settling at the time of the purchase the destination of a repair charge, as purchases of this nature have probably caused more trouble in cost accounting than any other class. If the procedure here outlined is followed, it is not difficult to account properly for all the incoming material, so far as the records are concerned. In addition, the receiving clerk is given information which will enable him to deliver immediately these repair parts to the master mechanic's department in order to get the crippled equipment into operation.

### **Services of Various Natures**

In a manufacturing institution of any size there is a constant need for outside services. Structural workers, boiler-makers, special mechanics, various contractors, etc., are called upon to perform work of specialized nature or to undertake work which the organization of the plant is not able to handle.

The request for a purchase of this nature originates with the master mechanic, except in such cases as when the accounting department sends for auditors, or the general superintendent for consulting engineers, etc. Regardless of who makes out a request for purchase, exactly the same explanations should be given as required for special material purchased

for repairs. In fact, the procedure is almost identical—particularly in respect to giving the exact charge to be made for the services performed. The only difference which enters into the procedure is that services of this nature are naturally not received in the receiving room, but are certified to by the one who is in touch with the service performed and who is in position to make affidavit that full value was received.

### **Advertising, etc.**

It is quite rare that the purchasing department arranges for such matters as advertising and other publicity features of the selling department. In cases where such contracts are arranged, the department or official arranging the obligation should, upon conclusion of the agreement, fill out a request for purchase, giving all data and particularly the account to be charged, in order that the purchasing department may cover the obligation with a proper confirming order.

In many cases this confirming order is made out purely for the purpose of record, the original of the purchasing order not being sent to the one in whose favor drawn. These orders are sometimes known as "dummy orders," and are placed on record merely to make sure that the invoices are properly O K'd when they come in—a step which is absolutely necessary.

### **Miscellaneous Purchases**

In nearly every manufacturing plant many miscellaneous deals are consummated, such as telephone contracts, telegraph arrangements, power contracts, etc., which may or may not be handled by the purchasing department. These purchases are in the same class as advertising, etc., and should be handled in identically the same way. In such cases it should be understood that a request for purchase is to be made out immediately upon the consummation of any arrangement.

### **Importance of Accounting at Source**

Repeated mention has been made of the importance of settling the accounting at the origin of each purchase. If the account to which each purchase is to be charged is decided upon at the source, and the account number placed on the request for purchase, the account number can be entered on each purchase order. It then becomes possible by automatic means to place this information on each invoice as it is received and approved. This is the simplest and most approved procedure. The receiving clerks know exactly what to do with the material when it is received, to what stock-room it should be sent, or, in the case of charges to standing orders, to what department it should be delivered. This method has its bearing also on the handling of the invoices in the stock record division and in the cost department.

Failure to decide at the source upon the account to which a purchase should finally be charged has been the cause of more work and lost time than any other one point in connection with the handling of cost records, and therefore it is urged that this point be given the most careful attention by anyone who may be attempting the installation of cost records.

### **Receiving Material**

Much discussion has been given in the past to the methods of receiving material upon its arrival at the plant. The discussion has been principally in connection with whether or not a copy of the purchase order with quantities and all data should be given to the receiving clerk or whether the receiving department should report what is received without any guide. In deciding this particular point the size of the plant and the nature of the organization must be taken into consideration. The proximity of the purchasing to the receiving department has a large bearing upon the question.

For example, if the plant in question is a very large one, the position of the receiving clerk becomes of such importance that there is no question but that he should be furnished with a copy of every purchasing order with full information thereon. Moreover, in such a case the receiving clerk has none of the actual checking and counting to do, and accordingly will not be influenced through his knowledge of the quantities or prices which may appear on the purchase order.

Unquestionably, those who actually open and check the packages should be working on a blind basis in order that they will give a proper report of the nature and count of the material. If the individual opening packages has before him a list of what is supposed to be in the package, with the quantities specified, he is liable to be more or less influenced by the information which he holds. If the plant is so small that the man who actually opens the goods is the receiving clerk, he should certainly not have a copy of the purchasing order with quantities thereon.

If, on the other hand, the plant is of sufficient size to maintain a number of checkers, it is apparent that as the receiving clerk himself is elevated above the point of being influenced by the count, and in fact becomes the intermediary to verify the accomplishment of the actual counters or checkers, he should be given the records in order to be sure that a proper count is made of the incoming material. He can detail his subordinates to open and count the material, giving a blind report thereon. He can then check this report with what was supposed to have been received, and act accordingly.

### **Inspection of Incoming Material**

Another very important feature of the receiving end of the business is the verification of the quality of the material received. Sometimes material is opened and counted by receiv-

ing clerks and then passed on to the inspection department, where it is again taken from the packages and inspected for quality. It is then necessary for the inspection department to count the goods again in order to give a complete record of the number of good and defective pieces received in the shipment. It seems needless to have two separate and distinct counting operations when they might just as well be combined into one, particularly when it has been proved that it can be accomplished without confusion. The receiving clerk should therefore be given full jurisdiction over all the men who are actually doing the work, but the method of inspection and the equipment to be used during inspection should be entirely under the *functional* control of the inspection department. The standards of quality should be set and supervised by the inspection department, the receiving department being furnished with all necessary drawings, gauges, etc., in order that proper inspection may be made.

This method of operating is economical, in that it saves space and has the effect of effectually speeding up the work of disposing of incoming material.

## CHAPTER IX

### TRANSPORTATION CHARGES

#### Problems Connected with Transportation Charges

There is probably no other part of the cost accountant's work regarding which there is so much question as the handling of freight, express, postage, and all other forms of transportation charges. In many concerns the practice has been very erroneously followed of charging all incoming freight to a factory expense account and of charging outgoing freight as a sales expense, for no other reason than the assumption that material coming in is used in manufacture and material going out is sold. The problem of the correct distribution of transportation charges is most important; a full and satisfactory solution must be found if the business is to show cost figures which are at all accurate.

The fact that the material enters the plant is no proof whatever that all incoming transportation charges are a factory expense, as will be explained later. Further than this, even supposing that all the incoming charges were to apply to material which was to be used in manufacture, the ratio of transportation charges on some material to the price paid to the vendor for the material might be two to one, whereas with some other material the transportation charges might be only one-twentieth of the price paid to the vendor for the material. This fact alone will show that for any industrial institution to throw all incoming transportation charges into an expense account is a procedure that is almost ridiculous.

The situation is similar as regards outgoing transportation charges. While some of them may have to do with sales, others may be for raw material returned as defective, or for



many other items which have nothing whatever to do with sales expense.

This chapter deals with the various types of transportation charges. In order to exhibit all these types in compact form, the various kinds of transportation charges commonly used have been listed below. This tabulation is followed by a detailed discussion of each kind of charge.

### **Incoming Transportation**

Incoming transportation charges are incurred on the following classes of goods:

1. Purchased goods.
2. Goods returned by customers.
3. Samples, etc., not covered by a purchase order; this case sometimes occurs though it is bad practice.
4. Goods refused or condemned.
5. Receipts of miscellaneous nature.

#### **1. Purchased Goods**

*F.o.b. Works of Purchaser.* The charges are either prepaid by the shipper, or paid by the purchaser and deducted when settlement is made for the goods. In such cases the straight invoice value is the correct cost of the goods.

*F.o.b. Works of Vendor—Freight Allowed.* The accounting of the charges is identical with that for "f.o.b. works of purchaser," but the traffic department has the responsibility of pushing all claims for damage with transportation companies, as by the terms the goods belong to the purchaser immediately upon shipment.

*F.o.b. Works of Vendor.* The company pays all charges, in addition to the invoiced price of the goods. This means that in entering the cost of the materials in question on the price books or stock records, the cost will be the invoice price plus the freight charges.

## 2. Goods Returned by Customers

*Goods Returned on Account Error.* The charges are entered either against a special expense account to show the exact cost of such errors, or against "Miscellaneous Expense Freight." The situation is somewhat the same as in the case of "goods returned on account error," except that in foundries and like institutions the charges should in all cases be entered against the expense account for "Returned Castings Loss."

*Goods Returned—Miscellaneous.* Many times goods are returned when ordered in error by customers. Charges on goods returned for this or similar reasons should be recovered from customers when possible, but when for selling or other reasons it is thought best to absorb the charges, they may be charged to Miscellaneous Expense Freight.

## 3. Samples, etc.

Theoretically there should be no incoming materials other than as specified under other headings, but usually there are isolated instances of samples, etc., coming in which are not covered by purchase orders. In all such cases the transportation charges should be charged to the expense account receiving the benefit.

## 4. Goods Refused or Condemned

Great care should be taken that all transportation charges on goods refused because of error, or because condemned, are charged to the shippers. In any case of the fault of the company, or of doubt, when the company finally has to pay charges, the charge should be made, *not to the material accounts*, but to *Miscellaneous Expense Freight*.

## 5. Receipts of Miscellaneous Nature

There are quite often receipts of various materials not otherwise specified. These may consist of traveling men's

equipment, exhibits returned from conventions, transfers between offices and plant, and many other items.

In all cases of this nature, either a specially designated Miscellaneous Expense Freight account, or some other expense account, should be charged with cost of transportation. For example, suppose an exhibit is returned from a convention. The freight charges on this should be charged either to an expense heading under selling expense called "Convention Expense," or an account called "Selling Miscellaneous Expense Freight."

The main point to bear in mind is that it is of no use to throw all charges into one account, but that it is far more valuable to charge all such transportation cost to the expense account which receives the benefit, and which should be increased by the cost of such transportation. (See also 7.)

### Outgoing Transportation

Transportation on outgoing goods covers:

6. Shipments of sales.
7. Shipments of returned purchased goods.
8. Shipments of samples.
9. Shipments of miscellaneous nature.

### 6. Shipments of Sales

*F.o.b. Works of Purchaser.* In this case either charges may be prepaid or shipment may be made collect, allowance being made for the freight when the customer pays the invoice.

*F.o.b. Works of Seller.* In this case the usual procedure is the prepayment of charges to any prepay stations on railroads or express lines and the payment of parcel post charges.

*F.o.b. Works of Seller—Freight Allowed.* This case is treated like that of "shipment f.o.b. works of purchaser," except that the customer has full responsibility for goods immediately on shipment.

### 7. Shipments of Returned Purchased Goods

*Goods Refused or Condemned.* See case (4). Outgoing charges are treated like incoming.

*Goods Returned Account Buyer's Error.* The charge should be made to Miscellaneous Expense Freight.

### 8. Shipments of Samples

In most cases of shipments of samples the charges should be made to "Miscellaneous Expense" of the selling department. This does not always hold, however, as in the case of the purchasing department sending out samples of material for duplication. In such instances the charge should be made to *Miscellaneous Expense Freight*.

### 9. Shipments of Miscellaneous Nature

There are many shipments of miscellaneous nature the transportation charges of which should be charged against various expense accounts. For instance, the charges for a bundle of advertising material sent out by express should go to "Advertising Miscellaneous Expense." In the case of a typewriter shipped for repairs, the charges should go to "Office Sundry Expense," etc. (See [5].)

### Accounting for Transportation

Before applying specifically the directions just outlined for handling freight of various kinds, it is necessary to discuss briefly the actual ledger accounts which are affected by the various charges, with a description comprehensive enough to permit of clearly outlining the procedure which should be followed in connection with each class of charges. Almost every control account of any importance in the ledger may at some time or other be charged with some form of transportation. This is especially true in the case of material inventory accounts and expense accounts.

Transportation charges consist of five main divisions, as follows:

1. Charges to be deducted from payment of invoices, covering freight charges of any nature which are paid by the purchaser of material, etc., but are to be deducted from the settlement for the goods in accordance with the terms of the purchase.
2. Charges to be added to invoice, consisting of whatever may be expended in prepayment of outgoing shipments, by freight, express, postage, etc., which is to be added to the invoices for the outgoing goods.
3. Charges to be absorbed in cost of goods, including payment on incoming goods, which have to be added to the invoice cost of the goods in order to determine the real cost delivered at the plant.
4. Charges on delivery of sales, covering transportation charges which have been included in the sales price of goods shipped to customers. These charges are not to be added to the invoice.
5. Charges of an expense nature, covering a multitude of cases, both incoming and outgoing, in which the transportation paid is a direct charge to some one of many expense accounts; these expense accounts may be of any nature, perhaps bearing the name of transportation charges, perhaps appearing in one of the expense accounts as shown in the standing order code.

To make clear the handling of the charges in these various types of accounts, each class will be taken up separately with reference to the tabulated statement of the various kinds of transportation charges.

### **1. Charges to be Deducted from Payment of Invoices**

The charges to be deducted from payment of invoices are of a troublesome nature so far as the accounts are concerned, because of the danger of paying a large volume of incoming freights and failing to deduct the payment from the settlement of the invoices for the goods on which the charges were paid. If accuracy is to be assured, it is necessary to create a holding account for such charges in order to maintain an adequate check and insure that all deductions are properly made.

In this connection it will be well to refer to Form 13 (page 106), the rubber distribution stamp placed on all invoices at the time they are received. This form, which is self-explanatory, should be constantly borne in mind in the description which follows.

Freight bills often have to be passed through and paid a long time before the invoices for the goods arrive. With all freight bills the following method should be used:

A ledger account should be established called "Freight to be Deducted." This account should be charged with incoming freight which is to be deducted from the vendors' invoices, and credited with all deductions made in the cash disbursements book in settlement of these invoices.

A subsidiary book should be kept in which should be entered the detail of each debit made to the Freight to be Deducted account—one item to a line, with space alongside each detail entry to permit of a corresponding detail entry made from the cash disbursements book at the time this freight is deducted in settlements.

This procedure, although detailed, has proved many times to be a most profitable feature, bringing about a saving far in excess of the extra cost. When the freight bill comes to the purchasing department for accounting, it is identified as to the purchase order to which it applies. If the goods were purchased "f.o.b. works of purchaser," the freight bill is

charged to the Freight to be Deducted account, that fact being so noted on the bill. The name of the vendor is written alongside the rubber stamp. This freight is then entered in the record of material received on the purchase order (see Form 7), and when the invoice is received the terms and the amount of freight paid are filled in on the rubber stamp. This gives the accounting department the full details so that when the settlement is made for invoices of this nature, the proper deductions may be made.

It can now be readily seen that on the subsidiary record of the items in connection with the Freight to be Deducted account, the debit entries which have no credit against them are shown very clearly, and it is possible to make sure that all freight payments of this nature are recovered from the vendors.

In actual practice, this account proves useful in taking care of the transportation charges involved when purchase terms are "f.o.b. works of purchaser" and "f.o.b. works of vendor—freight allowed" (see page 114).

## **2. Charges to be Added to Invoices**

Up to the time when parcel post became so popular, almost the same question was involved in connection with items of transportation paid on outgoing shipments, when the charges were to be added to the invoice, as in the case of freight to be deducted. In lines of business in which heavy transportation charges are paid on outgoing shipments, a method similar to that in the case of freight to be deducted should be used. The method of handling is almost identical with the exception of the fact that the credits to the account—called "Freight to be Added" account—come through the medium of the sales journal, rather than the cash disbursements book.

The parcel post, however, is now so largely used that in many plants almost every shipment involves the payment of

parcel post charges, with the further complication of adding these charges to the invoice. To carry out the detail as specified for the Freight to be Added account would be altogether too great.

In such a case it would be advantageous to create a ledger account called "Outgoing Parcel Post" account, without keeping the detail of each charge in any subsidiary record. The detail should, however, be provided for by small charge slips, or by some method of noting this information on the shipping order, in order that the invoice department may receive the information necessary to bill the customer properly. In entering the sales the amount of parcel post paid out should be credited to the Outgoing Parcel Post account.

When shipments are made to the purchaser without prepayment of transportation charges, the deductions for such charges, when the terms of sale prices cover delivery to works of purchaser, should be made through the cash receipts book and should be treated as if the amount had been added to the invoice.

The comments in this section apply to shipments "f.o.b. works of seller" and "f.o.b. works of seller—freight allowed" (see page 116).

### **3. Charges to be Absorbed in Cost of Goods**

In all cases when purchases are made with the transportation terms "f.o.b. works of vendor," this means that one of two methods prevails:

1. The charges have been prepaid by the shipper and added to the invoice.
2. The receiving company pays the freight charges.

In the first case the accounting is quite simple, as the entire invoice is charged to the account shown by the purchase order, thereby indicating the freight or other kind of trans-



portation bills involved, the total being used in computing the unit cost of the material.

In the second case the invoice comes in simply billing the goods, and there is in addition a bill for the transportation charges entirely separate from the invoice. In this case the transportation bill is charged to the same account to which the material is charged, the amount of freight being shown on the invoice in the rubber stamp. The result is that the stock record department must combine the invoice cost and the transportation cost, and compute therefrom the unit price to be used in charging out the material, which thus represents the cost of the material delivered at the plant.

This covers goods purchased "f.o.b. works of vendor" (see page 114).

#### 4. Charges on Delivery of Sales

Probably there are more errors made in the entry of transportation charges paid out on the delivery of sales to customers than in any other item in connection with transportation charges.

It is unfortunately the custom in many industrial institutions to treat the delivery cost of sales as a selling expense. This is entirely erroneous. The cost of delivering goods to purchasers is one which may vary from the cost of trucking the goods next door to paying the transportation charges for delivering the goods across the continent.

Every argument is in favor of treating the delivery cost of sales as an item which will appear in the profit and loss statement as a deduction from the sales, the resulting figure being the exact amount received for goods at the plant of the shipper.

The objection may be urged that the price for many goods is fixed, and the selling price of the goods must be the same in all localities—at least for a district bounded by the Atlantic

Coast and the Mississippi River. Within this district, however, the actual transportation charges will vary greatly.

The majority of industrial institutions have a fixed price for large territories, and for those plants the amount of delivery cost is of extreme importance. It should be clear that including delivery charges in the selling expense, or any other expense, creates a cost to be added to the manufacturing cost, which may result in a loss of near-by business.

If a company were in competition with another company whose operations did not extend very far from the locality in which the plants were operating, and the manufacturing costs were identical, the company whose operations extended into a large area would lose all local business because of having the selling expense loaded with the cost of long-range transportation. The result would inevitably be a falling off in the near-by trade with an increase in the long-distance trade, inasmuch as the selling prices would be too high near-by and too low for far-away points.

The argument that the prices must be made lower on the far-away points is a fallacy, in that this policy contemplates taking additional selling value from near-by points to make possible the lower price for far-away points. Manifestly, that cannot continue very long. If a manufacturing institution on the Atlantic seaboard wishes to maintain sales across the continent and yet hold the sales of near-by points, it can do so only because the intrinsic value of the product together with proximity to raw materials, giving it an advantage over western manufacturers, allows it to sell at a price which will absorb the freight charges. In other words, time is bound to demonstrate that selling prices at distant points cannot be maintained at the expense of near-by sales.

The procedure in this case is to create for each selling account a companion account to hold the cost of delivery of such sales. This account should be called "Freight Out on

Sales" prefixed by the title of the particular sales account to which it belongs. It would be charged with all freights connected with the delivery of sales, whether prepaid or whether deducted by the customer in settling for the goods. In the latter case the entry would come through the cash receipts book.

In any event, the transportation charges connected with the delivery of sales should be a *direct deduction from the gross sales* through the medium of the Freight Out on Sales account, and in no cases should be treated as a selling account.

This provides for shipment "f.o.b. works of purchaser" (see page 116).

### 5. Charges of Expense Nature

Charges of an expense nature are very inclusive, embracing all the items in the tabulated statement of freight charges not already discussed.

It is best not to try to specify in absolute detail every type of charge, since the tabulated statement (pages 114-117) gives a sufficient clue to the various entries of incoming and outgoing transactions involving transportation charges. The point to observe is that very particular attention should be paid to the distribution of the transportation charges which affect the various expense accounts. If that is done, the problem is merely one of determining carefully which accounts should rightfully be penalized with the charge.

A few instances will illustrate the consideration which should be given to the individual case in order to find the line of least resistance and discontinue bunching freight charges into one or two large accounts that give no clue as to their analytical nature.

A machine tool may break down and have to be returned to the works of the maker for repair. The charge for transporting this machine back and forth is as much a cost of the

repairs to this machine as the actual invoice which is later issued by the company making the repairs. These charges accordingly should be made to the standing order number covering the repairs of this machine.

A company may have branch offices necessitating the shipping of samples or supplies of various natures. Most certainly the transportation charges on this material should be charged to the branch office expense if an accurate line is to be kept on the cost of operating the branch.

Material which a company may have shipped out and which the customer rejects as defective is returned. The charges for transporting this material to the customer—which he will probably bill back—together with the cost of getting the material back to its starting point, should most certainly be charged to the account which holds the cost of defective material.

The transportation charges on samples shipped to customers are undeniably chargeable either to a "Samples" account or a "Miscellaneous Expense" account of the selling department.

Illustrations without number could be given to bring out the fact that there is every argument against bunching transportation charges into one big account, or into two accounts, such as "Incoming Transportation" and "Outgoing Transportation." Such bunching of freights results from a failure properly to analyze the costs of the business and such laxity should be corrected.

## CHAPTER X

### STOCK RECORD ACCOUNTING

#### Organization of the Stores Department

After material and product have been received and recorded in the receiving room, and the proper reports have been sent to the departments entitled to receive them, the material is turned over to the storeroom to which it is consigned. The storeroom should be properly arranged with bins or spaces to take systematic care of the material, and should be well equipped with pans, racks, drawers, bins, boxes, etc., according to the most approved storeroom practice.

While the organization of the storeroom will naturally depend on the size and nature of the general organization, certain features should be kept in mind in considering the placing of the stores organization in the general organization.

Every plant, if of sufficient size, should have a general storekeeper or material supervisor, who has jurisdiction over all storerooms. Each individual storeroom should be in charge of a storekeeper who has entire control of all necessary assistants in the storeroom. Clerical work in the storeroom should be reduced to the absolute minimum, and should consist only of such work as is necessary to follow out the rules in connection with the reporting of receipts and disposition of the material in the storeroom, and of all detail in connection with the requisitions or bills of material which act as vouchers for the material which is issued from the storeroom.

In plants where a comprehensive method of production control is in effect, the control of the storeroom should be vested in the production control department, as the control

of all material movements is one of the most important functions of production control. Where there is no production control department, the jurisdiction of the storerooms would best be vested in the general superintendent. He is the official particularly interested in what scheduling and production takes place and, therefore, should have control of the movements of material which so vitally affect the efficiency of the production department.

Finally, the storerooms should not be under the control of the purchasing department. Purchasing is an art by itself, and the purchasing agent should have no interest in the details involved in the storing and issuing of material. Such details only detract his attention from the markets.

As a general practice, the stock records should not be under the jurisdiction of the storekeeper, as it is easy to see that the records of the material on hand are a constant check on the operations of the stores force.

### **Use of Stock Records**

Stock records should be used for raw materials, supplies, individual parts, semi-finished parts, subassemblies, major assemblies, and finished product. It is impossible to cost product if individual parts and assemblies are not accounted for by stock records, because the parts for assemblies may be taken from a mass of parts in a department, the costs of which may vary materially but which nevertheless are not indicated on stock records. Yet in many plants, unfortunately, individual parts and subassemblies are left to accumulate on work benches and on the floors in operating departments instead of being put in storerooms until they are requisitioned for assemblies.

### **Accounting Theory of Stock Records**

The use of stock records is the practical application of the personalistic theory of accounts, which, it might be remarked,

is the distinguishing characteristic of triple and quadruple systems of bookkeeping, known also as logismography and statmography respectively. This theory, in brief, is that certain persons in the employ of a concern are responsible for the assets in their possession. These persons are charged with the quantity and value of assets placed in their care and credited for releases thereof. Thus the storekeeper is held accountable for the materials and supplies under his control. Stock record sheets kept by the stock record clerk furnish the means of checking the activities of the storekeeper, if the former is not under the supervision of the latter.

### **Names for Stock Records**

A variety of terms synonymous with the term "stock record" are in use, namely: stores record; balance of stores record; book, running, going, continuous, or perpetual inventory; stock card; and stock record sheet. The latter term is coming into vogue more and more.

### **Stock Record Forms**

Four different kinds of records are used in accounting for stock, namely:

1. Bound books
2. Visible index
3. Stock cards
4. Stock record sheets

Bound books for stock records are obsolete. The visible index would be the preferable kind of record in accounting for stock if all the data needed could be readily seen. Stock cards are probably used more than any other class of records, but are being supplanted more and more by stock record sheets with linen-backed separating sheets, this method permitting greater speed and permanency.

### Sections of a Modern Stock Record Sheet

A knowledge of the accounting theory of stock-recording aids in understanding the technique of keeping the records. After the general theory is understood, however, the general technique may best be understood by studying separately the operations involved in keeping each section of the stock records. The following parts of the stock record sheet (Form 14) will be considered in turn:

1. Heading
2. Requirements columns
3. Appropriated columns
4. Ordered columns
5. Received columns
6. Issued columns
7. Adjustment columns

This stock record sheet is inclusive enough to fit all possible needs of a firm. If a given firm does not wish all the data provided for, the columnarization, etc., can easily be revised. It is usually easier to reduce than to enlarge a stock record sheet. The form here shown eliminates the need for a balance column by providing running total columns. Most stock records, however, still show a balance column.

#### 1. Heading

The heading of a stock sheet may show:

1. The name of the item (material, individual part, or assembly).
2. The kind of material in the item.
3. The size, type, and symbol of the item.
4. The cubic space block is filled out whenever material, etc., is shipped on the basis of cubic feet, or when cubic feet should be known in order to provide sufficient storage space.





5. The name of the stockroom where the item is stored and its location (section, shelf, bin) therein.
6. The size and kind of raw material required for the item, if it is an individual part or an assembly, etc.
7. The name and weight of a unit of the item, whether the pound, gallon, barrel, foot, yard, or piece.
8. The unit of purchase is not always the unit of consumption. For example, steel is bought by the pound but may be used by the foot. In order to get the consumption unit, a "converting rate" is applied to the unit of purchase.
9. The "Made From" memo indicates the kind of material from which a finished or semifinished part, etc., was made. The "Used For" item shows the kind of product into which the item of material or finished part goes.
10. In the year and quantity blocks the consumption of material, etc., is shown by years.
11. The account number is the number of the material controlling account for the item of stock indicated on the sheet.
12. The time required to get an item after a purchase order is placed is shown.
13. The principal source of supply is noted, if most of the purchases of the item are made in one place. This is apt to be more common in the case of specialties than staples. Not all sources of supply are entered on the sheet.
14. The monthly quantities of the item required, as indicated by the production schedule prepared by the control or planning department, are entered in the "Required" table.
15. The maximum and minimum quantities by months are shown, if the consumption of material varies.

## 2. Requirements Columns

The quantity of each class of raw material or finished parts needed for production or sale is entered in the requirements column. The quantities appear in the item column. Each item required is added to preceding requirements and the sum is extended to the total column, which is a column of running totals. The requirements are ascertained by the stock record clerk from the control or planning department.

## 3. Appropriated Columns

The appropriated—or reserve—columns show the quantities of material and parts, etc., which are set aside for certain orders that are given priority over other orders.

An illustration which shows how the appropriated columns are used is as follows:

APPROPRIATED			
For Order No.	Item		Total
	Total	Quantity	
200	400	400	400
150	300	300	700
200	600	200	900
150	900	600	1,500
300	700	700	2,200
200	1,000	400	2,600

Appropriations of stock for order number 200 are made on three separate dates before the total amount of 1,000 units is appropriated, as shown in the requirements columns. When the total requirement for the order is appropriated, the entry in the requirements column opposite order number 200 is checked with the last entry in the appropriated column.

## 4. Ordered Columns

The ordered columns show purchase order dates and numbers, detailed quantities ordered, and cumulative totals.

201

### 5. Received Columns

In all cases entries are made in this column from receiving reports which accompany the stock into the storerooms. The prices are recorded later when invoices arrive. Stock records should be kept up to date and should not be held up because of non-arrival of invoices.

The "price" is the cost of each unit of each quantity received. This unit cost should include inward transportation charges like freight, express, cartage, parcels post, etc. If an invoice covers more than one class of material, the transportation charges in connection therewith should be distributed to the various stock records concerned, in proportion to the respective "rough invoice" costs of the classes of material received or to the weight of the material. In extreme cases inward charges are treated as an overhead item. This is not good practice, however, because it does not produce accurate costs. In cases where the stock record sheet shows the movements of parts and assemblies, the price would be their unit manufacturing cost up to the time of storage. The received section has a running total column.

### 6. Issued Columns

The issued section is the credit part of a stock record. Entries are made in the issued columns from material requisitions and shipping orders. The latter are used when the finished product accounted for by the stock record is sold. The former cover materials, parts, etc., issued to operating departments.

### 7. Adjustment Columns

Physical inventories often differ from book inventories. The latter, strange as the fact might appear, are usually more accurate than the physical inventories. The causes of differences are manifold, some of them being errors and omissions

in recording, waste, shrinkage, change in moisture content, inaccurate weighing, measuring, and counting, etc. Differences should be run down, if possible, and corrected or adjusted as the case may be.

Sometimes a stock record sheet carries an adjustment column with two subcolumns captioned "Over Credit" and "Under Credit," respectively. This column is used to adjust clerical errors and discrepancies between book and physical inventories. There is no especial need of providing for the column since adjustments can just as well be made directly in the other columns affected. If adjustments are numerous, however, a special record, termed "inventory adjustment sheet," is sometimes provided.

Total adjustments are recorded in the journal so that the material controlling account, stock record sheets, and physical inventories may be kept in agreement. Adjustments are debited or credited, as the case may be, to an Inventory Adjustment account or Over, Short, and Damage account; and credited or debited, correspondingly, to the material inventory controlling accounts. After the details are adjusted on the various stock record sheets, the controlling accounts will "tie up" with the subsidiary records—the stock record sheets.

### **Material Requisitions**

Materials, parts, etc., requisitioned from storerooms are originally recorded on material requisitions prepared in duplicate and signed by foremen, or by the planning or control department, or by some other originating authority, according to the organization of the plant.

A sample form of material requisition is shown in Form 15.

The originating authority fills out the main body of the requisition up to the "Stop Here" space, and also the "Charge" and "For" spaces on the bottom part of the form. Opposite

[illegible]

**Form 15. Material Requisition. (Size, 6 x 4.)**

the storeroom and his initials in the "Filled from" and "Filled by" spaces, respectively.

The storekeeper should keep a loose-leaf book indexed with the names of the persons who have the authority to prepare requisitions and should absolutely refuse to honor a requisition unless it is properly filled out and signed by a person who has the authority to sign. Neither should a requisition be honored if it calls for the issuance of more than *one class of material*. *No requisition* should carry or charge more than *one order*.

The stock record clerk enters each requisition in the issued columns of the proper stock record sheet, and prices each item. In no case should the stock record clerk make these extensions. A comptometer operator now makes the extension of prices and amounts after the "Stop Here" space, and initials the requisition on the "Extended by" line.

<b>HOLDEN MANUFACTURING CO.</b>				
<b>BOSTON, MASS.</b>				
<b>SCRAP TICKET</b>				
Order No. _____			Date _____	
Piece No. _____				
<b>NO. PIECES</b>	<b>DESCRIPTION</b>		<b>MATERIAL</b>	<b>WEIGHT</b>
<b>DEBIT</b>				
<b>CREDIT</b>				
Condition of Piece _____				
Reason for Scrapping _____				
Returned to _____			Rec'd by _____	
Approved _____			Signed _____	

Form 16. Scrap Ticket. (Size, 6 x 4.)

The original requisitions are forwarded to the cost department, where the material credits and work in process debits are accumulated, as explained in Chapter XIX. Each requisition is initialed by the clerk who makes the distribution. All requisitions are then filed under their proper order numbers.

### Accounting for Scrap Parts

In the manufacture of any article there is always present the necessity of accounting for units of material which are spoiled and which have to be accounted for. For this purpose a scrap ticket (Form 16) may be put in general use in any

industry. The methods of using the form, however, may differ according to the circumstances.

It is to be noted that the scrap ticket calls for the order and piece number, and is designed so that only one kind of piece shall appear on one ticket. The quantity of the same kind of pieces of scrap will appear under the heading "Number of Pieces," followed by its description, kind of material, and weight.

On the lower part of the ticket a line is provided for a notation of the exact condition of the piece—that is, a description of the extent to which the piece was manufactured. When the operations are well defined, a notation of the last operation performed is sufficient. If operations are not well defined, it is necessary to indicate what has been done to the piece.

The reason for scrapping the piece is then entered and notation made as to what point the material was delivered. The person who receives the material initials the line marked "Received by."

The accounting in connection with scrap material consists of two phases, which explains the number of lines left under the debit and credit headings.

The cost of the piece, up to the time of scrapping, should be found from the records, and an entry made in the credit column whereby work in process material, labor, and overhead will receive credit up to the point where the material was spoiled. The total of these three costs will be entered under debit against whatever account is designated to receive the cost of the spoiled work pending decision as to either reclamation or final scrapping. As most of these cases indicate that the material is to be scrapped, a further entry will be made showing the debit to Scrap account for the scrap value of the piece, and credit to the account which was debited with the full cost value of the spoiled work.



It may be well to mention at this point that when a piece is issued for assembly and found defective at the time it is to be used, it should be returned to the storeroom in exchange for a new piece. The storekeeper will then make out all the

[illegible]

**Form 17. Material Credit Slip. (Size, 6 x 4.)**

scrap tickets in connection with such material. Under this method the responsibility is centralized, rather than scattered throughout the assembly department. Scrap tickets for individual parts should be made out, as to original data, by the inspectors and approved by the chief inspector.

## Material Credit Slips

Material returned to the storeroom for any reason is first recorded on a material credit slip (see Form 17). The ac-

count or order number which was formerly charged with the material requisitioned and which is now to be credited, is entered on the credit line. The name of the storeroom and of the storekeeper in charge are written on the next line. The rest of the procedure with reference to the form is self-explanatory in view of the description of the handling of a material requisition. In short, the material credit slip reverses the accounting made when a material requisition is filled. Data on material credit slips are entered in the received columns of the stock record sheets.

[illegible]

**Form 18. Stock Record Card. (Size, 8 x 5.)**

In addition to showing the balance on hand almost as well as the balance column, running total columns give the up-to-date accumulation of amounts<sup>1</sup> used for any period. As a result a large saving is made in the clerical work involved in keeping the stock records.

## Simple Stock Record

Form 18 shows a stock record of simpler design. This record is kept in the same general way as the stock record sheet just described. The only columns in this record which are not a part of the modern stock record are the due and balance columns. The due column shows amounts not delivered on purchase orders placed. The balance columns provide for the differences between receipts and requisitions.

Running total columns have to a large extent taken the place of the balance columns in modern stock record sheets.

The use of this form is not recommended, as it does not carry the essential information required.

## CHAPTER XI

### RECORDING THE CONSUMPTION OF MATERIAL

#### Scope of Chapter

Before taking up this chapter, the reader should review the mechanism of the original control, use, and movement of material as outlined in Chapter V, so as to get a bird's-eye view again of the use and movements of material and the forms and records necessary to record and control the movements. Reference was made in that index chapter to the chapters in which the forms and records affecting material control and costs are treated. In the present chapter no attention will be given to forms. The subject matter dealt with is:

1. The value of specifications of product in recording the the consumption of material.
2. The methods of recording the consumption of material.

#### Value of Specifications—1. Definite Knowledge of Material

A specification of product is a typewritten or blueprint sheet, prepared usually by the engineering department, and showing the kind and amount of material which enters a given product. For example, specifications are drawn up to show the material that enters individual parts, the parts that enter sub-assemblies, and the subassemblies that enter major or final assemblies. Specifications of any nature should be standard in nature, definitely prescribed, and carefully preserved for reference.

One principal advantage of specifications in connection with the recording of the consumption of material is that the

material necessary for the manufacture of the product is definitely known.

## **2. Facilitation of Control, Costing, etc.**

The purchase, control, scheduling, and costing of material cannot be done accurately unless the specifications are complete. As a matter of fact, specifications really become the basis of all operations. In order to be serviceable, the specification numbers of the components of each material item or part should be entered on the heading of the stock record sheet covering the item or part. Conversely, the specification number of the item into which each kind of material, individual part, and subassembly enters, should also be indicated on stock records covering these components. Thus a cross-index is provided for cost and production purposes.

## **3. Facilitation of Standardization**

Furthermore, specifications lead to a standardization of operations because they show just what material and parts are necessary to make the product. One desirable result of standardization of operations is that costs of different runs of the same item and different items themselves can be intelligently compared.

If a firm has the option of using different processes for the manufacture of the same item, or the option of using different parts or subassemblies in the manufacture of a product, its management can decide intelligently which process, parts, and subassemblies to use. In other words, specifications provide the basis for carrying out the principle of economic selection or substitution.

## **4. Saving of Clerical Work**

Another principal advantage of specifications lies in the saving of clerical work. Since specification sheets show the

kind and amount of material and parts required for the manufacture of product, no need exists for writing out on requisitions long lists of material and parts that enter the product. This work is eliminated by simply recording on the requisition a notation, such as "100 sets of Specification No. 300." Consequently, the work of recording and handling materials, parts, and subassemblies on the part of the stock record clerk, operating, production control, and cost departments, is greatly reduced.

### **Methods of Recording the Consumption of Material**

The consumption of material is ordinarily recorded by use of material requisitions, as explained in Chapter X. The consumption of certain materials, however, is recorded by what might be called the "predetermining method," although this method often involves the use of material requisitions also. Another method of accounting for the consumption of material is sometimes known as the "tag method." Tags, however, may be used as requisitions. For this reason the tag method may be regarded simply as a specified feature of the requisition method.

### **Predetermination Method**

Specifications enable short cuts to be taken in recording consumption by the use of the predetermination method. This is especially useful where the quantity consumed on any one order is small, or when the exact count or measurement of the material at the time of its consumption is difficult. In cases of this kind the amount of material which enters the product is ascertained by exhaustive tests of "runs" of product. The results of these tests, which show the average consumption of material and the cost thereof, are recorded on specifications which form the basis for future charging of material consumed. This method is of course not employed

for all the classes of material used in a given plant, but is frequently employed to record the use of :

1. Glue in any industry.
2. Nails in any industry.
3. Ink in the printing industry.
4. Certain material in a shoe industry.
5. Rivets in a boiler-shop.
6. Lumber in certain cases.

To illustrate, the procedure used in recording the consumption of glue is as follows: Suppose a run of 100 chairs in a chair manufacturing plant is put through the necessary operations. The glue pot, as well as its contents, is weighed before work on the run is started. The total cost of the glue is charged to the run. The run is credited with the cost of the glue left in the pot when work on the run is completed. From the data recorded in connection with this particular run, a standard weight and cost of the glue used per 100 chairs, per chair, or whatever the unit is, plus a small percentage to cover a possible error, could be used as a basis in charging future orders of chairs manufactured. The results of tests are preserved on specification sheets.

The entries to controlling accounts for the consumption of glue are handled in the following manner: The glue is drawn from the general stock or storeroom and is charged to a Shop Glue account, Chair Materials account, or some other account which has a caption to indicate its true nature. This account should be regarded as one of the work in process material accounts rather than a stock account.

### **The Findings Account**

In the shoe industry—for another illustration—purchases of certain material are charged to a Findings account. The kind and amount of findings which enter a given unit of prod-

uct are ascertained from test runs. These figures are used in the future charging of findings consumed. The consumption of such material, therefore, is not charged to production orders by material requisitions or expense debit slips. Large batches of findings, however, may be issued to productive departments upon receipt of requisitions in the storeroom. Predetermined figures used in charging orders are credited to the Findings account. The accuracy of predetermined costs is checked up at the end of the fiscal period by comparing the physical inventory of findings with the balance in the Findings account. If a difference exists, it is proof that the estimate was over or under, as the case may be. The difference is cleared through a material adjustment account.

#### **Use of Predetermined Figures in Charging Rivets**

Still another illustration may be found in accounting for rivets in a boiler-shop. The amount of rivets used on an order is not positively known in advance of operations on an order. The quantity used on past orders, however, is ascertained by tests which include a certain percentage to cover burnt rivets. This quantity is entered on a specification sheet which is referred to thereafter in deciding the amount of rivets to be issued from stock. This amount also serves as a basis for the charge to be made for rivets consumed on orders.

#### **Method Used in Box Factory**

Another case is that of the use of lumber, when the ultimate quality and quantity to be consumed is unknown at the time the lumber is put in process. The use of lumber in a boxshop where, say, four grades of boxes are being manufactured from one kind of lumber, will serve as an illustration.

The lumber which is used for the manufacture of boxes of the first grade must be entirely without knots; the second grade must have not more than two knots per unit; the third



grade not more than four knots; and the fourth grade may have any number of knots above four. In cutting the lumber the sawyer keeps in mind this classification of grades. He sets his gauges on his saw and then cuts as much of the first grade as he can. If while cutting he comes to a stretch of lumber that has two knots in it, he does not treat these knots as waste but cuts the full side of lumber which is serviceable in the manufacture of the second grade of boxes. He follows the same general practice in cutting lumber for the third and fourth grades of boxes. By so doing there is little waste, so far as knots are concerned.

In order to get specifications for the boxes to be made, test runs are put through. The quantity and cost of each unit of each class of boxes made is indicated on the specifications which are referred to in costing future orders put through the technical processes. A sample specification might read as follows: "The cost of the first grade of boxes should be charged on the basis of the cost of lumber (free of knots), plus the cost of the normal waste in using the first grade of lumber." The specifications for the other grades of lumber would be worded in the same general way.

### **Methods Used by Chair Manufacturers**

In the case of a plant manufacturing chairs, the actual lumber used would be charged to a Chair Lumber account. This account would be credited with the standard charges for lumber consumption based on predetermined tests, and Work in Process Material accounts would be charged. Any difference in this Chair Lumber account would be passed through a Material Adjustment account. The amount of the adjustment would give the management a line on whether the use of predetermined figures resulted in overcharging or undercharging the orders of chairs, and would indicate the necessity of changing the standards used.

The following method is used by many chair manufacturers. The lumber—raw material—is scaled as it is piled, and the average measurement of “courses” per pile is determined. Stock records are kept for each pile and for lumber delivered to cut-off saws from kilns.

In some cases the exact measurements of lumber requisitioned to the factory are kept in detail on the stock records. The values of such lumber are the average prices per foot delivered to the planers.

Chair manufacturers in some cases set standard values on the various parts of lumber in the rough sizes, which correspond somewhat to prices paid for dimension lumber. Naturally, the larger and more valuable pieces would be priced at a higher rate per foot than smaller and less valuable pieces. With these standards as a basis, the value of the product at the kiln is calculated and charged to shop lumber accounts and credited to the lumber accounts charged at the time of purchase. The shop lumber accounts are credited at the time that Work in Process Material accounts, burden accounts, and the various jobs are debited for lumber which goes into the manufacture of chairs.

### **Safeguarding of Predetermined Material Costs**

In all the suggestions given herewith, in connection with the use of predetermined or standard material costs, in cases where actual measurement of the materials used is very difficult, there should be provided a specific means of checking the results.

This is easily accomplished by having a shop account to cover material drawn from the main storeroom, which material will be requisitioned in bulk and used on the various items of work in accordance with the necessities.

The credits to this Shop Material account will come from the requisitions which represent the use of same at the pre-

determined rates, which credits should not go to the main storeroom account, as this account has already been credited with the bulk withdrawals.

It will easily be seen that by following this method the balance in this account should at all times represent the exact amount of material on hand in the shop unused, which permits a check-up at any time in order to verify the fact as to whether or not the predetermined rates are correct.

### **Tag Method**

Another feature in connection with recording the consumption of material in certain cases is the use of tags, by means of which much clerical work is saved and the accuracy of the records is increased. This method is followed when the quality, weight, etc., of the material which is not in standardized packages—calendered rubber in rolls, for example—can be identified by tags put on at the time the weight is ascertained. Tags can be used as requisitions if so desired.

Tags are also used in the paper manufacturing industry to account for the consumption of pulp. With the exception of a class of raw material known as “fillers,” all pulp purchased in uniform-sized bags is weighed upon receipt. A tag is attached to each unit of pulp showing the date of receipt, class of material, vendor’s name, lot number, and wet weight of material when received. The wet weight is not necessarily the weight of the material when it enters the product, because pulp loses weight during storage. This new weight is figured after a dry test and is known as the “dry weight.” Furthermore, the wet weights of two units of purchase of equal quantity will not be identical when received because of different percentages of moisture content. This variation of moisture content calls for considerable care in recording the consumption of pulp, as the natural drying of the material causes a difference in the basic weight used.

Until the pulp reaches the machine known as the beater, however, no great difficulty is experienced in accounting for its costs. As the pulp is consumed, the tags for each unit are detached and sent to the cost department. Only the dry weight as shown by the tags is used in charging the product and in crediting the pulp accounts. The losses in weight of the pulp are sometimes treated as direct charges to Profit and Loss. This is not a good method, however. To arrive at standard costs, the cost of the loss in weight should be absorbed in the cost which shows the dry weight of the pulp consumed.

Tags are used also by furriers and by lumber manufacturers in accounting for certain classes of material.

#### **Use of Graduated Containers and Tote Boxes**

Storerooms and equipment may be so arranged that the shelves and containers used in storing hold multiples of count or weight. In many plants, fire clay, sand, and coal are stored in wooden or concrete bins which have marks on the sides to designate quantities therein. With this arrangement the physical inventory can be taken quickly by leveling the material in the bins and then noting the markers which graphically show the amounts on hand. This layout is a distinct advantage in the counting and recording of material. It is easy to determine the quantity in bins and other containers at the beginning of a cost period, the quantity put in bins during the period, and the quantity on hand in the bins at the end of the period.

In handling stores another feature which can be employed in many manufacturing plants, is to have tote boxes which contain specified quantities of material. As the contents of tote boxes are automatically known, and as the quantities consumed can be easily determined, the verification of the stock records is facilitated.

### Importance of Accuracy of Original Data

This whole chapter is intended to convey to the reader the enormous importance of very specific attention to the collecting and handling of the data from the shop in respect to the consumption of material. The various suggestions made are not intended to be any complete guide in handling any particular proposition, but are expected to assist the reader in giving a clue as to what procedures may be taken to safeguard and simplify the original data.

It has been a very unfortunate custom in the past to follow the rule that where it seems a little difficult to account for material, to immediately consign this material to the overhead. This is a situation which must not exist if accurate costs are to be found, principally on account of the fact that if glue used in chairs happened to be hard to account for, it would be manifestly unfair to charge this into the overhead, and thereby swell the burden cost on some articles of furniture which used no glue at all.

With the suggestions given in this chapter, anyone should be perfectly capable to work out the disposition of all material which enters into a product by means of tests, in order to eliminate entirely the entries in burden which will only tend to clutter up burdens with costs which should by no means be included.

It is, therefore, a matter not only of accuracy as to the accounting and recording of original data, but also of accuracy as far as confining direct materials and labor to the direct charges, and such confinement is really easier than has been thought by many in the past, providing intelligent measures are taken to work out standard charges along the lines suggested in this chapter.

## CHAPTER XII

### METHODS OF PRICING REQUISITIONS

#### **Where Prices Should Appear**

The requisition price for each class of stock should be clearly marked in some convenient place. It may appear on the heading of each stock record sheet or stock card, or in columns adjacent to the transactions, as explained in Chapter X. Prices are sometimes calculated on the basis of opening inventories and current transactions of receipts and requisitions for the cost period. Pricing requisitions from a separate price record, however, involves double work. This can be avoided by recording values as well as quantities on stock record sheets or stock cards.

#### **Person Responsible for Pricing Material**

When material requisitions are filled by the storekeeper, they are turned over to the stock record clerk for entry and pricing, provided the stock record sheets are designed to show both quantities and values of materials. No pricing is done by the stock record clerk, however, if stock record sheets contain columns for quantities only. In this case the requisitions are priced by the cost clerk.

#### **Components of Material Costs**

The basis for costing requisitions should include inward charges like freight, express, and cartage, in addition to the invoice cost of materials. These inward charges are sometimes erroneously treated as an item of manufacturing overhead. Stores expense, however, should be treated as a component of factory overhead. In an ordinary manufacturing

concern too much clerical work is involved in distributing stores expense over individual material requisitions.

### **Methods of Determining Prices**

Problems of deciding who shall do the pricing and what shall be regarded as the cost of the material, do not present so many difficulties, however, as the problem of determining the actual cost of each unit requisitioned. Regardless of the method of pricing, the total material costs of the business as a whole for the year are substantially the same during normal times. The total material costs for each cost period during the year, however, and for each individual job, may be somewhat different under the various methods. If the prices of material were always the same during a given period, uniformity in pricing requisitions would be the rule because all methods would produce the same results. The original price method, therefore, would be universally used, since it would be the only natural one to use. In the following pages the technique of the various methods and their advantages and disadvantages are discussed.

### **Using Original Prices of the Oldest Stock on Hand**

The method of using original prices in costing requisitions is the best method for materials that are purchased other than staples, such as pig iron and scrap in a foundry. No great difficulty is experienced in operating this method. When the original prices of the oldest stock on hand are used, it simply means that the prices of the stock first purchased are used first on requisitions, then the prices of the second lot purchased, and so on. This method is illustrated by the table on page 153.

In pricing, it is sometimes necessary to use two prices when the filling of the requisition exhausts all of the units purchased at one price and includes part of another lot bought at a

different price, as in the case of the January 5 transaction shown.

RECEIPTS				REQUISITIONS			
Date	Quantity	Price	Value	Date	Quantity	Price	Value
Jan. 1	100	\$1.20	\$120.00	Jan. 2	50	\$1.20	\$60.00
" 3	200	1.40	280.00	" 4	40	1.20	48.00
				" 5	10	1.20	12.00
					70	1.40	98.00

Requisitions of bulk material, such as lumber, and requisitions of semifinished parts, are priced at *original cost* when it is practicable to keep costs by lots. The original cost method is particularly applicable when the prices of such materials fluctuate violently. Some contend that if it is desired to ascertain *real costs* and *real profits*, it is the only accurate method.

Another advantage of the original price method is that it keeps obsolete stock from accumulating, since stock is used in the order purchased.

Moreover, a company "plays safe" when it makes a contract on the basis of material costs "at the time," as these may change before work is started on the contract. If the price of material rises before the contract is commenced, the company has "covered," i.e., has insured a supply at a price that will enable it to make a profit. This is a more conservative method of buying materials than the method of gambling on the way the price will move. It is true that if the price drops after material is contracted for, the company loses the difference in the prices, but it would also lose if material were not contracted for and the price rose before the job were started. A manufacturer should be a *manufacturer* in fact as well as in name, and not a *gambler*. There are times, however, when the trend of the market is well known, and purchasing may be postponed until material is actually needed.



### **Basing Costs on Market Prices at Time of Consumption**

Materials consumed are not always requisitioned at cost prices. The North Carolina Pine Association published the following statement in its *Manual of Cost Reporting*: "Some mills make large advance purchases of supplies; when same are consumed the charges should be based on market value, otherwise such costs would not parallel those of the mills purchasing as needs demanded." This method helps to establish uniform methods of cost-finding in the lumber business and is in harmony with the principle of basing costs on market conditions.

The foregoing method is employed also in the iron and steel and similar industries. Suppose that pig iron is purchased under a contract for \$25 per ton, and that the price for pig iron during a given month, as quoted in the *Iron Age*, is \$30 per ton. As pig iron contracted for is bought, purchases are debited at \$25 per ton. This method of pricing necessitates the use of an intermediate material profit and loss account known as the Pig Iron Adjustment account. This account is charged and the Pig Iron account is credited at the average actual contract price of pig iron. The Melt account (work in process account) is debited and the Pig Iron Adjustment account is credited at the *Iron Age* price of pig iron for the month. The balance of the adjustment account is closed into the current Profit and Loss account.

### **Average Price Method**

The best method for costing requisitions of staples, like pig iron, scrap iron, fuel, lumber, etc., is to use average, mean, or "base" prices. More clerical work, however, is involved by the use of this method because every change in the price of material bought necessitates the calculation of a new average requisition price. Mistakes, therefore, are apt to occur unless great care is exercised in running stock record sheets. The

technique of the average price method is indicated by the following table:

RECEIPTS				REQUISITIONS			
Date	Quantity	Price	Value	Date	Quantity	Price	Value
Jan. 1	100	\$1.00	\$100.00	Jan. 2	20	\$1.00	\$20.00
" 3	110	1.20	132.00	" 4	50	1.12	56.00
" 5	120	1.40	168.00	" 8	100	1.25	125.00

Bar steel is sometimes requisitioned by the average price method. At the end of each month the withdrawals of stock (both weight and cost) are subtracted from the sum of the inventory at the beginning of the period and the purchases for the period (both weight and cost). The difference in weight is divided into the difference in cost and the average price per unit of weight is ascertained and used during the succeeding month. This method may be used in connection with materials where the requisitions for them must be priced immediately and currently for the month.

There are many cases, however, where this rule should not be used, as it is necessary to price the material at the average cost for the month in which it is used instead of the average value of what is left at the close of the month, as described above.

An illustration of this would occur in a foundry where pig iron, scrap, coke, etc., are charged in on the basis of what was consumed through the month and at the average cost for the current month. In this case, the material received during the current month is added to the inventory at the beginning of the month as to weight and total amount of money, the totals of which are divided to arrive at the average cost for the month. The amount used during this month is then priced at this average. After being deducted from the previous total

mentioned, the inventory at the end of the current month will stand at this average unit price.

This procedure should be used in all cases where costs of this nature are figured by the month, as it gives the actual average for the month instead of using the average unit cost of what was on hand at the beginning of the month.

It is not generally believed, however, that the average price method should be followed in requisitioning finished parts. The advocates of this method point out that finished parts should be requisitioned out in the order made and at original cost because this method more truthfully reflects *actual* costs.

Whatever method is adopted by the cost accountant for general use, it is clear that when material is bought for some specific job or contract it is better to use the actual price rather than the average price of similar material bought for other jobs.

### **Using Original Prices of the Highest Priced Stock**

Another method of pricing requisitions is to use the original cost of the highest priced stock. The main reason for using this method is one of precaution—to protect the concern against a decrease in the market value of material. It is, therefore, considered a conservative method. It may not be, however, if the highest price of materials is used in figuring bids on contracts. If business is lost because bids are too high, the method may defeat its own purpose. (See Chapter XI for explanation of the profit and loss adjustment used in connection with this method.)

### **Pricing Prepared Material**

Material manufactured in the plant—often termed “prepared material”—should of course be charged with all manufacturing costs and requisitioned at that price. This method

has been discussed in Chapter XI, where the statement was made that dry weights of pulp, rather than wet weights, serve as a basis in costing pulp in a paper industry.

### **Pricing Work in Process and Finished Product**

Work in process when converted into either finished parts or finished product is charged with manufacturing costs incurred during conversion. Finished parts are requisitioned for assemblies at these prices and sales of finished product are priced at manufacturing cost. When finished product is bought, the purchase price is used in costing the sales of finished product.

## CHAPTER XIII

### MINIMUM, MAXIMUM, AND QUANTITY TO ORDER

#### **Importance of Maximum and Minimum Quantities**

No problem of stores organization and control is more important than the establishment of economical maximum and minimum quantities to be carried in stock, because severe losses occur if proper lower and upper limits to stock are not set. Insufficient stores slow up operations and necessitate a revision of production control plans. Orders cannot be filled on time and as a result many are canceled. This discourages salesmen because of lost sales and commissions. Buyers become skeptical of the ability of the manufacturer to complete deliveries according to contract. Laborers are forced to be idle and cannot earn average wages; consequently they become disgruntled, lose faith in the management, and may quit because of dissatisfaction with conditions.

On the other hand, failure to observe the maximum limits may be just as uneconomical as failure to keep enough stock on hand. If quantities in excess of maximum requirements are on hand, too much capital is tied up in stock, with the result that carrying charges for stock, such as interest, rent, storage, insurance, and taxes, are needlessly high. Furthermore, excessive stock encourages waste. Careful attention to maximum limits materially reduces the amount of stock carried. There are cases where stock has been decreased as much as 50% by fixing reasonable maximum limits. Thus the turnover of stock is increased. It is just as important to keep stock moving rapidly in manufacturing enterprises as in merchandising establishments.

### **Need of Correlation among Departments**

Keeping stock within established limits depends to a great extent on close correlation among the stores, purchasing, planning—sometimes called control—and production departments. Before the beginning of each season, the production manager, with the help of the planning department, prepares a schedule of the materials which he expects to need during the coming season. It is the function of the storekeeper and purchasing agent to provide materials according to scheduled requirements.

### **Methods of Calculating Stock Limits**

Another function of the storekeeper is to calculate stock limits or minima and maxima. In his calculation he may either resort to the use of formulas or may weigh different factors which affect stock without regard to any formulas.

The minimum and maximum figures should appear on the heading of stock record sheets. When the consumption of material fluctuates from month to month, it is advisable to show the maximum and minimum figures for each month in a section especially provided for that purpose. In no case should stock limits be regarded as immutable. They are simply sign posts which serve as guides to economical purchasing. If material needs change, stock limits should be changed accordingly.

The minimum quantity for each class of stock may be physically separated from the rest in each receptacle by means of a red cardboard, bag, tape, or box according to the nature of the stock. Such a marker indicates when the minimum is reached. The minimum should not be sold or requisitioned until all of the other material in the receptacle has been sold or issued, thereby creating a real and useful physical control. This method can seldom be used, however, as it usually involves too much effort.

### Calculating Minimum and Maximum

Inasmuch as formulas in the last analysis are somewhat arbitrary, they are not discussed here. When used, their main function is to serve as a check against the judgment of the storekeeper. No storekeeper should feel bound to use formulas religiously, if his judgment dictates that corrections to them should be made before he establishes minimum and maximum limits.

Some of the factors to consider in fixing minimum and maximum under either the formula or the non-formula method are as follows. No attempt has been made to arrange these factors in the order of their importance.

1. The average consumption of material per unit of time.  
(This unit is usually a month or fraction thereof.)
2. The present and future needs for material, as indicated by the production schedule.
3. The time required to procure material when called for. This is probably the most important factor considered in fixing the minimum. It involves:
  - (a) The time required for placing purchase orders after receipt of purchase requisitions.
  - (b) The time needed by dealers to get stock ready for shipment after receipt of purchase orders.
  - (c) The time needed for stock to reach the place of consumption. This includes not merely the time in transit, but also the time the stock takes to pass through the receiving room, the storeroom, and the factory.
  - (d) A certain amount of time allowed as a safety factor to cover unforeseen delays in obtaining materials.
4. The maximum amount of material that a single production order might require.

### Determining the Amount to Order

A distinction is made in some industries today, between "maximum limit" and "amount to order." The "maximum limit" is an estimate of the largest amount of material that the company will need under the existing production schedule. The "amount to order" is the amount of material which should be ordered when the minimum is reached.

The factors which affect the calculation of the amount to order are:

1. The cost in dollars without considering the "set-up" or "getting ready" expense, or the carrying charges.
2. The set-up expense, which includes the cost of getting materials and tools ready to begin work on the order, and the cost of handling the order in the office and factory. Just the clerical expense incident to the handling of each order often averages as high as \$1.
3. The available storage space for material.
4. The movement of material; the greater the movement, the larger the quantity economically manufactured on one set-up of a machine.
5. The quantity of material on order.
6. The amount of material that can be bought economically.
7. The financial strength and credit of the concern.

The last factor is closely related to the matter of speculation. A firm may buy up a large quantity of materials if it has ample funds, hoping to save a tidy sum in case prices rise. During the World War when the general level of prices was rising, financing of inventories was more of an investment than a speculative proposition. In other words, the risk of a drop in prices was almost negligible, owing to the circumstances then existing.



The two figures—maximum, and amount to order—allow the purchasing agent considerable leeway in regulating his buying. In some cases it is more economical to place orders for large purchases on account of price considerations. In other cases, savings cannot be effected by exceeding the maximum.

### **Concurrent Calculation of Minimum and Maximum**

In the mind of the reader may arise the question as to the need for the concurrent calculation of minimum and maximum limits. The answer is that consumption of material fluctuates, particularly in businesses of a seasonable nature. Minimum and maximum quantities should vary accordingly. If it were possible to replace material as soon as requisitioned with an equivalent amount, only minimum quantities would be considered.

Lack of universal dependence on set minimum and maximum in purchasing is due to three primary reasons:

1. Absence of stock records.
2. Failure to appreciate the value of minimum and maximum.
3. Belief in the superiority of a substitute method.

The case of a large public utility in New York City will serve to illustrate the last reason. This firm does not depend on set limits as regulators of stock purchases. Its stores organization is so efficient that active stock (stock that has moved) is physically inventoried every three days and checked with related book inventories. The classes of stock handled number several thousands. The storekeeper frequently scrutinizes stock record sheets and notes particularly the balance on hand for each class of stock. He is always kept informed of the stock needs of the factory, and is thereby able to judge whether existing stock balances are sufficient. The manage-

ment believes that this system enables the storekeeper to keep in closer touch with his stock and to buy "right" than would a system which was dependent on minimum and maximum figures on each stock record sheet. This method, however, is largely a relic of old individualistic procedure, and has the result of depreciating the organized methods which are by far the safest and most to be desired. It is mentioned here to simply contrast such procedure with the accurate and automatic methods which should be followed.

Another reason for not using maximum limits might be mentioned. During the World War most firms did not worry about exceeding maximum limits because of the material shortage. Their concern was only with minimum amounts.

### **Calculating Finished Product Minimum and Maximum**

Finished product minimum and maximum amounts appear in headings of finished product stock cards. The calculation of these amounts depends upon :

1. The present and expected volume of customers' orders for different parts of the season, which figures are estimated on the basis of past sales.
2. The time element :
  - (a) The time required to get materials to productive departments.
  - (b) The time required to manufacture the product.

### **Necessity for Use of Maximum and Minimum**

The general trend of industrial procedure at the present time is that of specializing functions. This tendency finds no greater expression than in the regulation of materials of all kinds by stock records.

Probably the greatest use of the stock record is that it is an absolute guarantee of keeping up the proper quantities of

raw materials, supplies, and finished parts necessary for assembly and shipping.

In the accomplishment of this object, the data in connection with the minimum amount in particular, are of the utmost importance, as it is only on the stock records that the long vision into the future is obtained, as the result of the posting of the requirements from the incoming orders and the schedules of manufacture.

Probably more lapses in production occur from the altogether too prevalent excuse of no material on hand to work with, and probably no other single feature has so great a bearing on the cure of these lapses as the intelligent setting of proper minimum amounts, coupled with the intelligent use of same by the stock record division.

In this connection, it is assumed that the minimum has been properly set with due consideration to time of transportation, which varies according to the season of the year, and to all other contributing factors which have been described in this chapter.

In other words, the use of the minimum in particular in conjunction with stock records, which are kept up to date, fulfills the necessary function which no other record can possibly perform.

In comparison with the minimum and its proper use, the maximum is of far less importance, as this is more of a preventive against excess freight charges and against unduly large purchases which would swell the inventories of the company to too great an extent.

## CHAPTER XIV

### HOW TO TAKE INVENTORY

#### **Importance of a Correct Inventory**

The advantage of the perpetual inventory in preparing monthly financial statements is discussed in Chapter XXIX. Even when the perpetual inventory is kept, however, physical inventories should also be taken. The routine work involved can be distributed throughout the whole year, a few items being counted, weighed, or measured at a time and compared with the perpetual inventory. If discrepancies between the two are found, they should be corrected through the inventory adjustment account by a journal entry.

The balance in the inventory adjustment account should be carried directly to the Profit and Loss account. Sometimes a debit balance in the inventory adjustment account has been treated as a part of the manufacturing overhead. This treatment, however, is not good practice for the reason that no part of the factory organization may have been responsible for the discrepancies.

If the perpetual inventory is not maintained, a physical inventory of assets, such as material, supplies, work in process, finished parts, finished product, etc., should be taken at the end of the fiscal period. Financial statements can then be compiled which reflect the real financial status of the concern, and the changes that have taken place in the financial status during the fiscal period. A physical inventory, therefore, is the cornerstone of the accounting department. It is one of the most vital parts of the business compass which enables the proprietor to steer the correct course leading to the harbor of profits.

### **Old Method of Taking Inventory**

Until recently, the taking of inventory in most plants was dreaded. The feeling about it was similar to that experienced by a person who has a distasteful dose of medicine to take—the sooner it is over, the better. As a result, inventories were taken hastily, and a large part of the routine work was carried out without any prearranged plans. Consequently much of the inventory had to be taken again, which lengthened the period and increased expenses.

### **New Method of Taking Inventory**

The new method, known as the “duplicate tag method,” of taking inventory, is supplanting the old method in progressive plants. Under the duplicate tag method, detailed preparations are made long before the date set for starting the inventory, with much the same care that an army general plans his attack. Each employee who will participate in the work is assigned a definite task and is informed as to whom he should consult in case he should need advice. The steps under the new method might be outlined as follows:

1. Issuance of inventory instructions.
2. Counting, weighing, etc., the inventory.
3. Listing the inventory.
4. Pricing the manufacturing inventory.
5. Calculating and extending the inventory.
6. Checking the inventory.
7. Comparing the inventory.

#### **1. Inventory Instructions**

The best plan is to issue the inventory instructions in the form of typewritten sheets or a booklet. They should be distributed long enough before the date of starting the inventory to permit a thorough study of their contents. Schools of in-

structions in inventory methods are established in some plants for the benefit of those who will take inventory.

Unfortunately most instructions are loosely arranged. This fault can be overcome by grouping instructions for each department separately after the general instructions for all departments are set forth. The general instructions usually pertain to the following :

- (a) The length of the inventory period.
- (b) The personnel of the inventory committee.
- (c) The articles to be taken.
- (d) Special preparations.

#### **(a) Inventory Dates**

The length of the inventory period depends on the size of the plant—perhaps only a day or two, perhaps two weeks or more. In large factories most of the departments cease their activities during this period. In some small plants inventory can be taken without stopping all work, but even in such cases the routine could be expedited if there were a complete cessation of operations.

#### **(b) Personnel of the Inventory Committee**

The managers and departments heads are on the inventory committee. The committee is assisted by each superintendent and foreman; by tag-writers who make out inventory tags and list items thereon; and by workers who handle, count, and weigh, etc., the articles to be taken. Sometimes the accounting department supervises the taking of the inventory. In this chapter, the final authority, whether it be the inventory committee or the accounting department, is referred to as the "supervising authority." A chart showing how the plant is organized for taking inventory is sometimes prepared, and always proves of great assistance.

**(c) Articles to be Taken**

The names, definitions, and locations of the broad classes of articles to be taken, such as raw materials, supplies, machinery and equipment, furniture and fixtures, work in process, finished parts, finished products, etc., are mentioned in the inventory instructions. This broad classification of items is usually the balance sheet classification of assets.

**(d) Special Preparations**

The heads of departments are instructed to make certain preparations and to furnish the supervising authority with a list of the names and clock numbers of the clerks and laborers needed in order to take inventory in their respective departments. In order to expedite inventorying, various departments are assigned definite tasks as enumerated below.

*Inspection Department.* The inspection department is instructed to clean and inspect goods in the inspection cribs and work in process. This department also makes a list of defective material capable of correction through repairs.

*Salvage Department.* The salvage department is directed to prepare a list of all obsolete and scrap material. This material is sent to scrap storehouses if it cannot be corrected. Later the scrap is disposed of by the purchasing department with the aid of the inspection department. If scrap can be corrected, it is retained in the salvage department until inventory is completed. Then it is transported to the proper department for correction with a "corrective work order" attached. The salvage department moves goods sold but unshipped, for which shipping orders have been prepared, to storage places provided.

*Production Departments.* The production departments are instructed to clean up all spoiled, defective, or scrap goods; to sort and bring together all like job numbers; to put all articles in proper receptacles; and to send scrap to the salvage

department. In short, the production departments make a general "house-cleaning." Production departments should minimize requests for materials during the days which immediately precede the beginning of the inventory period, and should bring all work in process so far as possible to the same stage of completion.

*Storeroom Department.* The storeroom department is ordered to clean up, to sort and stack its material, and to place all articles in proper receptacles, marked so as to be readily identified. Scrap and obsolete material is weeded out and sent to the salvage department. Deliveries from storeroom to factory should cease or slow down several days prior to inventorying.

*Purchasing Department.* The purchasing department is instructed to draw up a list of unfilled purchase orders and contracts, arranged according to part numbers or names of material, as of the closing date of the inventory period, say December 31. All purchase invoices in dispute are promptly adjusted with vendors and sent to the accounting department before December 31. Invoices passed for payment prior to December 31 are recorded on the books, and goods covered thereby are considered as a part of the inventory even though not yet received. If sellers' invoices have not come in, memorandum invoices are made out by the purchasing department and sent to the accounting department for goods received prior to the beginning date of the inventory period, say December 29. All invoices which have been received from goods still in transit should be segregated and listed separately. These may or may not be taken into consideration, but it is sometimes good practice to do so, as goods shipped f.o.b. seller's works are, according to law, the *property of the buyer when in transit*.

The purchasing department requests outside concerns which have in their possession certain materials, tools, patterns, etc., belonging to the company which is making the in-



ventory, to submit sworn statements covering such articles. It also requests them to furnish a list of the above assets which they may have shipped back to the company a certain number of days prior to December 31. The purchasing department is urged to minimize the amount of material received during the inventory period. One way to help in this respect is to slow up delivery by ordering goods to be sent by freight which ordinarily are carried by express.

*Receiving Department.* The receiving department is directed to clear its floors of all goods received up to the time of starting inventory. Receiving records covering such goods are to be completed and quickly forwarded to the accounting department. Goods received after inventory has started are sometimes kept in the receiving room but are not included in the inventory. This is bad practice, as all dates must necessarily show as of the month which is included in the records. This of course applies only to goods actually received before final inventory date.

*General Accounting Department.* The general accounting department is instructed to obtain a list for the sales department of goods billed but unshipped prior to December 31, so that these goods will not be included in the final inventory. The goods may be inventoried, but the figures are subtracted from the "total" inventory to give the amount of the inventory to be used in preparing statements, etc.

If the general accounting department supervises the taking of inventory, it will have charge of all the tags and inventory sheets. Acting in this capacity, it will charge the tag-writers with the tags and sheets as issued and credit them with returns. The fact that tags are serially numbered helps the general accounting department to keep its records straight. When inventory has been taken, tags are returned to this department. Then they are checked by serial numbers and are sent to the cost accounting department.

*Cost Accounting Department.* The tags which the cost department receives from the general accounting department are sorted by classes. From these tags inventory sheets are prepared.

The cost accounting department is instructed to charge all manufacturing costs incurred before December 31 to the various classes of orders. It must see that price records are up to date so that goods may be priced correctly. The cost accounting department or the inventory committee is ordered to price, to calculate and extend, to check, and to compare the inventory.

*Co-operation of Departments.* The inspection, salvage, and production departments—in fact all departments—are instructed to co-operate prior to the inventory period for the purpose of minimizing the obsolete and defective material which cannot be corrected.

## 2. Counting and Weighing the Inventory

Before inventory starts, instructions are issued and studied. Each employee knows what he is to do. When the signal is given to begin, the workers in the charge of foremen or department heads commence to count, weigh, measure, or size inventory items. Goods should be counted, weighed, etc., *twice* before the tags are filled out.

## 3. Listing the Inventory

The results of counting, weighing, etc., are recorded in indelible pencil on the tags by clerks known as tag-writers. These tags are procured from the supervising authority. When obtained each contains a serial number only.

The tags for material are made in duplicate with perforated stubs and with wires for attachment to the material. As soon as a lot or section of material is inventoried, one tag is attached by the tag-writer to the lot or section, the other



and supplies. The inventory tag for finished material has the same arrangement.

Form 20 is an inventory tag for work in process. It requires a slight explanation. Assuming that the standard oper-

HOLDEN MANUFACTURING CO. BOSTON, MASS.			
INVENTORY COUNTER TAG No. _____			
PART No. _____			
NAME _____			
----- WORK IN PROCESS -----			
INVENTORY COUNTER TAG No. _____			
ORDER No. _____		DEPT. _____	
PART No. _____			
NAME _____			
DESCRIPTION _____			
CONDITION (No. & NAME OF LAST OPERATION) _____			
UNIT OF COUNT _____			
FIRST COUNT _____			
CHECKED BY _____			
MATERIAL			
PHYSICAL COUNT		UNIT COST	VALUE
REPORTED	ACCEPTED		
	1		
LABOR AND BURDEN			
LABOR	BURDEN		
	HOURS	RATE	AMOUNT
-----			
INVENTORY COUNTER TAG No. _____			
DEPT. _____		LOCATION _____	
MADE OUT BY _____			

Form 20. Inventory Tag for  
Work in Process. Size, 3½ x 7.)

ations on the work in process which is being inventoried are known, it is sufficient to enter in the designated space only the number and name of the last operation. This shows the condition of the work in process. If the sequence of operations is not known, however, it is necessary to count the number of

pieces of work in process completed under each operation and to show in detail the operations completed on each piece.

In the "Condition" or "Last Operation" space, is written information as to whether the goods are new, old, or usable. It is the practice sometimes to assign one or more engineers to special departments so that materials may be accurately described and last operations properly designated. If engineers are not assigned, tag-writers should possess sufficient information to fill out tags properly. The "Unit of Count" may be the pound, the barrel, piece, etc. Metal tags rather than paper tags are attached to machinery and equipment, to furniture and fixtures, and to assemblies.

As soon as inventory is completed in each department, the supervising authority is notified. Representatives of the supervising authority visit the department to see if everything has been inventoried. If so, tag-writers and others who have been working there are released and are assigned, if necessary, to other departments. The next step in inventorying is to pull—or detach—the original tags. No tags are pulled without the order of the supervising authority. After the tags have been pulled in a department, regular operations may be resumed, provided they do not interfere with work in other departments. Tags pulled are sent to the supervising authority and compared with duplicate tags. If the tags do not agree, a recount of the material represented by the tag is ordered, if the discrepancy is large enough to warrant a recount. Someone other than the person who took the original inventory makes the recount.

After the tags have been pulled, they are sorted according to the balance sheet classification of assets. The tags not only show quantities but also unit and total prices. In such cases the data on tags are entered on inventory sheets (Forms 21 and 22) which are in the charge of the supervising authority. After sheets are filled out they are sorted according to numer-



ical sequence, are checked as to completeness, and are then re-sorted according to the balance sheet classification of assets. That is, all raw material items appear in one batch of sheets, work in process in another, and so on. The complete inventory is then recapitulated on summary sheets, consecutively numbered—one sheet showing the totals of each asset.

#### **4. Pricing the Manufacturing Inventory**

The pricing of the manufacturing or work in process inventory must necessarily be effected through the current cost records.

Every order representing the work in process has its time cards and requisitions filed in the work in process files, and if a physical inventory is taken, the notations on the physical inventory as to operations completed should agree with the information given by the cost files as to number of pieces completed under each operation, which also gives the cost of same.

The requisitions in like manner should also account for the direct material cost and what is on the floors in process, thereby taking care of this feature.

In adding up the time cards in the files and extending these totals on the inventory sheets representing the work in process, the extensions of the burden at the standard rates for each department will furnish the total of the work in process burden.

With these three items of work in process cost ascertained from both the physical count and the current cost files, it is then an easy matter to arrive at the totals and thereby check the controlling accounts in the ledger.

These costs are always carried at what is shown in the work in process files, it being absolutely impossible to alter them to agree with any market conditions, as any change would be altogether impossible to accomplish.

*Use of Records in Pricing.* Raw material may be priced from stock record sheets, purchasing department records, accounting department records, market quotations, or by the engineering department or the works engineer.

Some persons hold that work in process is difficult to inventory. If material requisitions and time tickets have been properly filed behind orders in the standing order files, or posted to cost sheets, the calculation of work in process values is simply one of arithmetic. In some plants, cost sheets are not filled out until orders are completed, in which event the order files rather than cost sheets must be resorted to in figuring work in process inventories. This is the preferable practice. Under process systems the stage of completion of work in process is ascertained, the total cost of each process is ascertained, and the total cost of all processes is calculated. Work in process cannot be so easily figured under an estimating system.

Finished parts and finished products are priced from individual part cost sheets, assembly cost sheets, estimated records, or stock record sheets.

All of the above inventories should be priced at manufacturing cost. Selling and administrative overhead should not be capitalized in work in process, finished parts, and finished product inventories.

### **5-7. Final Steps in Taking Inventory**

The supervising authority has charge of calculating, extending, checking, and comparing the inventory. Much of the detailed work is facilitated by the use of various mechanical devices. All calculations on inventory sheets should be made twice, and the extensions and figuring checked.

Form 21 is an inventory sheet for the physical inventory of material and supplies. The same form is used for finished material or product. Form 22 is an inventory sheet for the



physical inventory of work in process. Two copies are made for each inventory sheet. The copies remain together until the inventory is priced. They are then separated and given to two separate clerks who extend the values without any connection one with another. The sheets are then brought together and the extensions compared, a method which will immediately expose any differences in extension requiring correction.

After the totals of the sheets which represent the material covered by each controlling account are ascertained, the controlling accounts may be verified and whatever adjustments are necessary can be made.

The inventory sheets are then separated and made up into books, one copy being filed away as a permanent record, and a copy used for current purposes in connection with stock records, etc.

## CHAPTER XV

### ACCOUNTING FOR LABOR—IN THE PLANT

#### Chapters in Which Labor Is Discussed

Accounting for labor is discussed in Chapters XVI, XIX, and XXI, as well as in this chapter. The present chapter has to do with the detailed accounting for labor in the plant by the dispatch clerk. The next chapter deals with the accounting for labor in the pay-roll office where summarization of labor costs are made. Chapter XXI on expense and burden statements treats of the compilation and presentation of indirect labor, as well as other burden items. Indirect labor is referred to briefly in this chapter, however, because the original records for indirect labor are made on time cards.

In order to differentiate clearly between the duties of the dispatch and the pay-roll clerk, the broad steps in accounting for labor might be outlined as follows:

1. Recording:
  - (a) Regular cases
  - (b) Special cases
2. Checking and extending
3. Summarizing

The first two of these steps—recording and checking—are in the hands of the dispatch clerk, and are therefore discussed in this chapter. Under special cases come the recording of the time of loaned workers, of work on other department standing orders, and of labor costs on short operations. As summarizing is in charge of the pay-roll clerk, it is taken up in the following chapter, as well as in Chapter XXI.

### Objectives of Labor Accounting

Accounting for labor in the plant, pay-roll office, and in connection with burden costs, has four main objectives:

1. To ascertain the amount of wages due each worker so that pay-rolls can be prepared.
2. To show the labor costs by units—whether they be jobs, contracts, classes of products, or departments, processes, etc.—so that proper direct-labor costs can be entered on cost sheets.
3. To provide data for figuring burden.
4. To provide data through the foregoing procedure so that proper control of labor may be maintained.

### Chief Forms Used in Labor Accounting

It will be useful to enumerate here the chief forms used in order to reach these objectives, together with a brief explanatory comment of their functions. These forms are:

1. *Weekly In-and-Out Card*. A clock card (Form 23) is assigned to each worker in order that he may record thereon the time when he arrives in the plant and leaves it—in other words the in-and-out time. The function of this card is the same in every plant, although its form may vary slightly.

2. *Time Card*. Time cards (Forms 24 and 26) vary according to the kind of labor information desired and the system of wage payment in use in the plant—regular daywork, piecework, or premium or bonus. As a matter of fact, the accounting for labor on time cards and other labor records probably depends more upon the system of wage payment than upon any other factor. Certain special cases that arise in accounting for labor will be discussed in this chapter along with the regular procedure of labor accounting.

3. *Late and Absent and Overtime Reports*. If a worker is present during the full working day his in-and-out card and

time cards will show this fact. If he is late or absent, or if he works overtime, this fact is entered on a late and absent, or an overtime report (Form 28 or Form 27), as the case may be.

4. *Pay-Roll Sheet.* The pay-roll sheet (Form 29, Chapter XVI) assembles the pay of each man from the time cards representing the detail of work performed, and supplies the basis for the journal entry for the distribution of pay-rolls. (See Chapter XIX.)

5. *Labor Transfer Record.* The labor transfer record (Form 30, Chapter XVI) is used to record the time and cost of workers temporarily loaned by one department to another. (See Chapter XVI.)

6. *O. D. S. O. Transfer Record.* The O. D. S. O. transfer record (Form 31, Chapter XVI) is used to record the details of work on other department standing orders. (See Chapter XVI.)

### **Weekly In-and-Out Clock Cards**

The weekly in-and-out clock card shows the time the worker enters and leaves the plant each day. The difference between the two figures for each day is the time when he is supposed to be in the plant. This figure is checked up with the time reported on the time cards. Inasmuch as the time cards show the time worked as well as the cost of the labor performed by each worker, it can be ascertained whether or not he was idle during any of the time that he was in the plant. Still another use is made of in-and-out cards, namely, to aid the pay-roll department in locating differences in the pay-roll.

### **Duties of the Dispatch Clerk**

Dispatch clerks—a term which is being used more and more in place of “time clerk”—see that the workers stamp in-and-out cards properly. Each week these clerks forward the in-and-out cards, after they have been properly stamped, to



Before taking up in detail the preparation of time cards, the various duties of the dispatch clerk, in so far as his duties in connection with timekeeping are concerned, may be outlined as follows:

1. To account for all working hours of employees in their departments.
2. To enter on time cards the time when operations are commenced by workers.
3. To place the card in a rack under the proper working place number.
4. To remove the card from the rack when the job is finished.
5. To enter the quitting time.
6. To calculate on the cards the elapsed time.
7. To turn in for each worker enough cards to represent the entire time he was present. These time cards are checked with the late and absent, and overtime reports for the purpose of noting any deviation from the standard number of working hours.
8. To stamp night and overtime on cards for night work and overtime.
9. To enter the quantity of work accomplished as called for in each case.
10. To enter all idle machine time on idle machine cards as specified. (See Chapter XXXI.)

### Time Cards

There are two principal kinds of time cards—one for direct or productive work (Form 24a) and another for indirect work (Form 26).

The direct-labor card is used to record labor which is chargeable to a production order; the indirect card is used to record labor chargeable to a standing order.

All time cards are similar in a general way, though they differ as to detail.

### **Time Cards for Direct Labor**

The same form of direct-labor card is used for all direct, that is to say, productive work whether it be done under the regular daywork, piecework, or premium or bonus system of wage payment—the regular daywork card being different from the piecework, bonus or premium card in color only. A recapitulation card—called the bonus and premium report—is used in conjunction with the direct-labor card under the premium or bonus system.

The daywork system is not as common as formerly, owing to the adoption of piece, premium, bonus, and other special methods of wage payment. In the opinion of some good observers, it may be remarked, the pendulum is moving backward toward the daywork system, but the reasons for this do not fall within the province of this volume.

The following is a detailed description of the data on the time cards for direct work (see Form 24a). The circled figures appearing upon the card have been inserted merely for the purpose of identifying the columns referred to in the following discussion.

1. **Worker's Number.** The worker's time-clock card number.
2. **Date.** Stamped with date stamp.
3. **Department Number.** The number of the department on whose pay-roll the worker belongs.
4. **Order Number.** This is secured from the production order or the standing order code.
5. **Machine Number.** The number of the machine which the employee is operating.
6. **Operation Number.** The identifying number of the operation being performed.
7. **Operations.** The total number of operations which are to be performed on the material.
8. **To.** The next operation to be performed on the piece.

USE THIS CARD FOR PRODUCTIVE WORK												HOLDEN MANUFACTURING CO. BOSTON, MASS.												Worker's No.	
FACTOR 32																								(1)	(2)
Dept. No.	Worker's No.	Order No.	Class	Type	Mach. No.	Qty.	Oper. No.	Good	Labor Hrs.	Pcs. Df'n.	Stk. Hr. Prod.	Pieces Good	Mach. Hrs.	Labor Hrs.	Quantity on Order	Labor Cost	Date								
(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)								
Description of Work												(21)		(22)		(23)		(24)		(25)					
Mach. No.												(26)		(27)		(28)		(29)		(30)					
Operation No.												(31)		(32)		(33)		(34)		(35)					
Oper. No.												(36)		(37)		(38)		(39)		(40)					
To												(41)		(42)		(43)		(44)		(45)					
From												(46)		(47)		(48)		(49)		(50)					
Inspector's Signature												(51)		(52)		(53)		(54)		(55)					
Earned For Day												(56)		(57)		(58)		(59)		(60)					
Card No.												(61)		(62)		(63)		(64)		(65)					

Form 24. (a) Direct Labor Time Card. (Size, 7 $\frac{3}{4}$  x 3 $\frac{1}{4}$ .)

This form is used for recording direct, that is to say, productive work, whether it be done under the regular daywork, piecework, or premium or bonus system of wage payment, the forms used under each of these systems differing from the others in color only.



9. **Class.** The class of goods being made, as shown by the product code.
10. **Type.** The type of goods being made, as shown by the product code.
11. **Description of Work.** A description of the goods being made.
12. **Operation.** The name of the operation being performed by the worker.
13. **Defective.** The number of pieces spoiled during the operation.
14. **Good.** The number of good pieces finished during the operation.
15. **Totals.** The sum of (13).
16. **Totals.** The sum of (14).
17. **Labor Hours.** See description of (32) "factor."
18. **Total Labor Hours.** See description of (32) "factor."
19. **Standard Hourly Production.** The standard rate per hour for this operation.
20. **Actual Hourly Production.** The actual rate per hour accomplished.
21. **Machine Hours.** Total number of machine hours.
22. **Hours Credit.** Number of good pieces divided by standard hourly rate of production.
23. **Checked With Clock Card.** A distinguishing check mark or the initials of the dispatch clerk who checks the labor card with the in-and-out clock card is entered in this space.
24. **Rate.** The rate of pay.
25. **Cost.** The labor cost which is the rate, piece or day (24), multiplied by the total number of good pieces made (16) if piece work, or the number of hours (18) if day work.
26. **Quantity on Order.** The total quantity of the particular product ordered.
27. **Last Balance.** The balance of the order left after the previous quantities made have been subtracted from the quantity on order (26).
28. **Balance To Do.** The quantity of the order which is still unfinished which is obtained by subtracting the total good (14) and defective (15) pieces from the last balance (27).
29. **Inspector's Signature**
30. **Earned For Day.** Total earnings for day is extended on last card for day only.
31. **Card Number.** Each worker's cards are numbered consecutively using 1 for the first card in the morning, 2 for the second card, etc. A circle is placed around the last card number. Cards are numbered consecutively for workers who have more than one card for a day's work, in order to insure the receipt of cards for the entire day.

32. **Factor.** The use of all time cards except the bonus card involves a somewhat special feature known as the calculation of factors. The factor is the term given to the number of machines a worker operates. It is shown on the horizontal scale across the top of the card.

By reference to the three cards (Forms 24b, c, and d) the method of calculating factors can be understood. Employee No. 526 started work at 7 A. M. on three machines, each of which is represented by one of the cards. At 10 A. M., machine No. 950 stops because of a breakdown. The hours that machines are idle are reported on idle machine cards. The worker continues to operate the other two machines, Nos. 951 and 952. From 7 A.M. to 10 A.M., therefore, worker No. 526 has operated three machines. Hence, his factor for that period is 3, that is, the same as the number of machines he was running. The factor is indicated on the three cards by drawing heavy vertical lines at 7 A.M. and 10 A.M. respectively, and writing the figure 3 between the lines. The difference in time as shown by the number of hours between vertical lines is 3. This figure is divided by the factor for that period, which is also 3, and the result is the labor hours—1—to be entered in space (17) (labor hours) on each card. While worker No. 526 continues to operate two machines his factor is 2. He resumes operations on machine No. 950 on the same production order at 3 o'clock and consequently his factor again becomes 3. Heavy vertical lines are drawn at 3 o'clock on all of the cards. On the cards shown in Forms 24c and d, 2 (the factor) is written between the 10 o'clock and 3 o'clock lines. The period represented by the difference in hours between the lines is 4, as one hour is taken off for lunch. This is divided by the factor 2 and the result—1—is the number of labor hours to be entered in column (17) on the second line on Forms 24c and d.

Suppose that worker No. 526 quits at 6 o'clock. From 3 to 6 o'clock he has been operating three machines. His factor

**Form 24 (b) Direct Labor Time Card Filled in to Indicate Use of Factors. (Size, 7 $\frac{3}{8}$  x 3 $\frac{1}{4}$ .)**

Form 24. (c) Direct Labor Time Card Filled in to Indicate Use of Factors. (Size,  $7\frac{3}{8} \times 3\frac{1}{4}$ .)



for that period is 3. The labor hours are  $3 \div 3$ , or 1, and are entered in column (17) on each of the cards. The next step is to calculate the labor hours on each card which are entered in space (18). These hours are 2, 4, and 4, respectively. The elapsed machine hours as shown by the cards are 6, 10, and 10 hours respectively. These figures are entered in space (21) on each card.

When the factor does not divide evenly into the elapsed hours (as  $1\frac{1}{4}$  hours divided by the factor), arbitrarily divide the time into even 15-minute periods.

### **Bonus or Premium Report Card**

The method of accounting for labor under the bonus or premium method of wage payment involves the use of regular time cards and the bonus or premium report card (Form 25), which is a recapitulation card of the bonus or premium earned by the worker. These cards are made out in duplicate. The original bonus report or premium card is given to the worker so that he himself can check up the calculations of bonuses and premiums made by the office, and the duplicate is forwarded with the product to the inspector of the product, and later the cards are forwarded to the pay-roll department. It should be clearly kept in mind that the bonus or premium reports do not obviate the need of regular time cards.

On the bonus or premium report are entered the basis of payment made to the worker, the date, time, and pieces made. The bonus is calculated as follows: The number of pieces required per hour is multiplied by the number of hours worked during the period. The result is subtracted from the number of pieces made to find the number of pieces on which a bonus is earned. The bonus rate is multiplied by this number to find the bonus earned. A glance at the bonus or premium report card (Form 25) will make this clear. On December 1 and 2 the employee whose card is shown worked 4 and 6 hours re-

BONUS OR PREMIUM REPORT										HOLDEN MANUFACTURING CO. BOSTON, MASS.									
PERIOD ENDING										WORKER'S NAME									
DEPARTMENT										WORKER'S No.									
BASIS OF PAYMENT IS <i>40 per hour .02 each over</i>																			
Dept. No.	Worker's No.	Order No.	Pieces Made	Dftv.	Good	Oper. No.	Class	Type	Bonus Earned	Pieces Good	Signed O. K. By	Cost	Date						
			450			450			\$1.00										
Records of Performance																			
Class	Type	Date	Time	Pieces															
		12-1	4	180															
		12-2	6	270															
			10	450															
					<i>Bonus Earned on 50 pieces</i>														
Operation																			

Form 25. Bonus or Premium Report Card. (Size, 7 $\frac{1}{4}$  x 3 $\frac{1}{4}$ .)

spectively, which means that he had to produce more than 400 pieces ( $40 \times 10$ ) in order to earn a bonus. The record shows that he actually made 450 pieces during that period. As 2 cents is paid for each piece on which a bonus is allowed the worker earned a bonus of \$1.

The bonus is then entered on the card and is added either to the regular pay-roll or to a special bonus pay-roll.

### Inspection

The time cards for direct labor discussed in this chapter call for entries of good and bad pieces. As it is frequently impossible to inspect the product in time, however, it is often necessary to record the number of pieces completed, whether good or bad, and to have a separate inspection report follow later.

### Time Cards for Indirect Work

Another important feature of labor accounting occurs in connection with indirect work. It will be remembered that time cards for direct work are chargeable to production orders. Time cards for indirect work (Form 26) are chargeable to standing orders.

Cards for indirect work are filled out as follows:

1. Worker's Number. The worker's time-clock card number.
2. Date. Stamped with date stamp.
3. Department Number. The worker's home department number.
4. Order Number. The standing code order number outlined on the order which accompanies the work or from the standing order code.
5. Labor Hours. The time spent on the work.
6. Rate. The worker's rate per hour.
7. Labor Cost. The time spent, times the rate per hour.
8. Description of Work Done. The description should be complete, e.g., "Repairing machine 50."
9. Complete. A check mark is placed here if work is complete.
10. Incomplete. Checked here if work is incomplete.



USE THIS CARD FOR INDIRECT DAY WORK AND PIECE WORK ALSO FOR IDLE MAN TIME PAID FOR																								HOLDEN MANUFACTURING CO. BOSTON, MASS.												Worker's No. <b>(1)</b>	
Date																								Date		Date											
Dept. No.																								Dept. No.		Dept. No.											
Order No.																								Order No.		Order No.											
Worker's No.																								Worker's No.		Worker's No.											
Description of Work Done																								Description of Work Done		Description of Work Done											
Labor Hours																								Labor Hours		Labor Hours											
Labor Cost																								Labor Cost		Labor Cost											
Complete																								Complete		Complete											
Incomplete																								Incomplete		Incomplete											
Earn for Day																								Earn for Day		Earn for Day											
Least Card Only																								Least Card Only		Least Card Only											
Card No.																								Card No.		Card No.											
Circle Least Card																								Circle Least Card		Circle Least Card											

Form 26. Indirect Labor Time Card. (Size, 7 $\frac{3}{4}$  x 3 $\frac{3}{4}$ .)

11. **Earnings for Day.** Extension of total earnings for day to be on last card for day only.
12. **Card Number.** Worker's cards are numbered consecutively. A circle is placed around the last number.

### **Recording Special Cases**

It will be remembered that the steps mentioned in accounting for labor were :

1. Recording :
  - (a) Regular cases
  - (b) Special cases
2. Checking and extending
3. Summarizing

The rest of the chapter will be devoted to a discussion of the special cases of labor accounting and the checking of labor cards.

Special features are :

1. Recording the time of loaned workers.
2. Accounting for work on other department standing orders.
3. Accounting for labor costs on short operations.

#### **1. Recording Time of Loaned Workers**

The first special case in connection with accounting for labor occurs in the recording of the time of loaned workers. When a worker is on a certain pay-roll and is loaned to another department for temporary service, and when no burden charge is involved, it is of course impracticable to change the worker's number. In such cases, accordingly, the following very serviceable method is used.

The dispatch clerk of the home department makes out two cards for the loaned worker, entering thereon the worker's number, the date, and the time he reported for work at the beginning of the day. Both cards are then stamped diago-

nally in the description of work space, "Transfer to Department Number . . . ." The dispatch clerk fills in the number of the department to which the man is transferred. One card is placed in the worker's space on his home dispatch board as a memo, and the other card is given to the worker to turn over to the dispatch clerk of the department to which he is loaned.

The dispatch clerk of the department borrowing the man fills in all other information as if the worker were one of his own men. He makes out any additional cards necessary to cover the man's time for the period, stamping all other cards the same as the first. At the close of the day—or upon return of the worker to his home department—the dispatch clerk sends the cards back by the worker, who reports back to his home dispatch clerk.

These cards are then forwarded to the pay-roll office like all other cards. The memo card held by the home dispatch clerk is destroyed—or used again after erasure of entries. The further special procedure in connection with the transfer is explained later in Chapters XVI and XIX.

## **2. Other Department Standing Order Accounting**

The second special case in accounting for labor occurs in connection with charges made by one department to any other department in a plant where the burden of the originating department must be incorporated in the charge.

While the filling out of the card is identical with any other entry of indirect labor, the card must be specially stamped in order to insure proper handling in the subsequent operations in connection with the pay-rolls. These cards are accordingly marked with a rubber stamp "O. D. S. O." in large letters. They should be stamped diagonally across the description of work so that they may be quickly and easily detected in the pay-roll department. Other than this, the entries on the cards

are the same as in all other cases, the only difference being in any one department when the standing order number will be for some department other than the one performing the work. The special handling of these cards is described in Chapters XVI and XIX in connection with the pay-roll distribution.

### 3. Short Operations

The third and last special case in accounting for labor has to do with recording the labor costs of short operations. Many manufacturing operations are of such short duration that it is impracticable to charge the direct labor involved to production order numbers through time cards. Hence, these operations are known as "short" operations and code numbers are provided for them.

An illustration of this may be cited in hardening taps. Many sizes are handled together—and each size may be on a separate order. To separate the time on each size and order is impracticable. Therefore all hardening time is charged to a code order or account called "Hardening."

It is necessary, however, to enter the actual cost of hardening each of various sizes of taps on the cost sheets. These costs may be estimated as follows: The cost of hardening each of six or eight sizes is determined by means of tests the results of which are then plotted on a chart. A curve drawn through these points will indicate the approximate cost of hardening intermediate sizes. The standard costs thus derived should be used on all cost sheets and the code order or Hardening account credited with like amounts. The total of standard costs entered on the cost sheets during a given period should approximate the total amounts charged against short operations during the period. If a discrepancy exists, adjustments should be made and the standard cost should be revised.

Although the time of short operations is not kept, a list of all products, their production order numbers, and quanti-



that the time cards for all workers in his department are checked. In order to do this properly he must be provided with a list of the numbers of the workers in his department and must prepare overtime reports (Form 27) and late and absent reports (Form 28). For exceptions to the regular hours of employment the procedure is as follows:

[illegible]

**Form 28. Late and Absent Report.** (Size, 5 x 7¼.)

Shortly after the whistle blows in the morning, and after the lunch-hour, each dispatch clerk takes the cards left in the "out" rack and keeps them in his dispatch booth. Any worker who is late reports to the dispatch booth for his time card and the dispatch clerk fills out on the late and absent report the worker's number and name, and the rest of the data called for on the report—which is self-explanatory. Absent time is recorded in the same general way from the cards of absent

workers and during the day for all workers who leave the plant before the regular quitting time.

From the passes issued for overtime the dispatch clerks prepare the overtime reports, which are also virtually self-explanatory.

For all workers who are present for the full day's work, the time on the time cards must total the regular hours—8, 9, or 10, as the case may be. After time cards are checked by dispatch clerks for full labor hours as well as for full machine hours, they are placed in numerical sequence and are then forwarded to the pay-roll office.

### **Extension of Cards**

The next step in accounting for labor is the extension of time cards. In different plants there will always be found a difference of opinion as to who should have charge of the file of day and piece rates, in order to accomplish the proper rating of the cards. In some cases the files of such rates are in the shops, and in other cases in one of the office departments, usually the pay-roll department. It is probably best to have the rating of the time cards as to rates per hour and piece rates confined to the office, if possible, in order that the information as to day rates, in particular, shall not be a matter of common knowledge. Irrespective of where it is decided that this work shall be done, after the contributing data have been entered on the cards the next natural operation is to have them rated and extended. This is purely a matter of referring to the day rate files in the case of straight daywork and in bonus or premium system based on daywork, and to the piece-work files in cases where the work is performed in this manner. The extensions on the cards should be made clearly and distinctly, and in all cases checked by someone else in order to insure absolute accuracy. After the cards have been rated and extended they are passed on to the pay-roll department, the

detail procedure of which is described in the following chapter.

The third principal step in accounting for labor is the summarization of labor costs. Summarizations are made on payroll sheets and on expense and burden statements. The first of these records is discussed in the next chapter, the last two in Chapter XXI.



## CHAPTER XVI

### ACCOUNTING FOR LABOR ON PAY-ROLLS

#### **The Triple Use of Pay-Rolls**

In connection with a detailed cost system, the pay-rolls are used for the following purposes:

1. To compute the worker's pay.
2. To effect certain controls.
3. To record on the pay-roll the number of pieces produced by each worker on direct operations. This is sometimes carried to the point of having entries of piece or bonus in separate columns from that of day-work in the direct-labor section.

It is not always best to try to accomplish too much with any one record, and therefore it is advisable to disregard the third function—that of analyzing the various kinds of work and quantities produced. Moreover, pay-rolls have to be made up on schedule time and too much detail is likely to hold back the work. A knowledge of how the worker's pay is computed and how the controls are effected may best be gained by a detailed study of the pay-roll sheet (Form 29).

#### **Condition of Time Cards on Delivery to Pay-Roll Department**

Before the pay-roll sheet is taken up, however, it might be well to insert a word about the condition of the time cards when they reach the pay-roll department. By turning over these cards in orderly and proper shape, the dispatch clerk can help the pay-roll department greatly.

It is very important, for instance, that the time cards be delivered to the pay-roll department with all cards representing



the day's work of each man. The cards for each man should also be in their numerical sequence, it being remembered that when a man uses more than one card per day the various cards representing his day's work are serially numbered.

It is natural that the cards should be in order, as the last move made by the dispatch clerk or time clerk should be to verify the fact that a man's entire time is represented by the time cards—after they have been checked with the late and absent reports and the overtime reports.

The cards should also be in sequence according to the worker's check number, as this is the condition in which they should be handled in the dispatch booth in the shop.

### **Arrangement of Pay-Roll Sheets**

The pay-roll sheets should be in binders and should be made ready for the entries of a pay period before the entry of the pay-roll is started. This means that the full data at the top of each pay-roll sheet should be filled in, including the department name, the name of the worker, his day rate, his check number, and the pay-roll period.

If the sheets are prepared ahead of time from the list of check numbers last known to be employed in the department, a great deal of time will be saved in the current work of entry.

In some places it has been found of advantage to have the pay-roll sheets loose during the posting period, as the sheets will then lie perfectly flat for entry. If this method is used, however, great care must be taken to see that none of the sheets become separated from the file.

### **Details Shown on Pay-Roll Sheet**

The first column on the pay-roll sheet is the date column, in which it is necessary to enter only the day of the month, as the period date at the top gives the other information desired.

The column headed "Slip Number" is for the purpose of

entering the serial number of the slips for the worker when more than one time card is required to represent his work. In this connection it is to be remembered that the serial number on the last card representing the day's work should be enclosed in a circle. This automatically shows the pay-roll clerk that all the cards for each worker are in hand. The column headed "Charge" is for the entry of the order number covering the work accounted for by the time card. This may be either a standing order number or a production order number. The nature of this order number regulates the entry of the time in the columns which follow.

There are five main blocks of columns across the sheet. The first four of these are of extreme importance, as they become the basis of the controls for each subsequent movement of labor through the medium of journal entries. Each has a very specific use, and too strict attention cannot be paid to mastering and understanding fully the uses to which they are put. The blocks are herewith described in regular order:

### 1. Transfer

The procedure in connection with labor which is loaned by one department to another has previously been described. When one department loans a man for some hours or days to another department, the time of loaning is usually not sufficient to warrant changing his check number, and therefore the method described in the previous chapter is used to obviate the mix-ups which might otherwise arise.

When the pay-roll clerk of the department recording the pay of a man who has been loaned to another department finds a card stamped "Transferred to Department A," he should enter this card under the transfer heading. This entry has the effect of registering the man's time for pay on his own pay-roll, and at the same time providing the entry in a column ready for use in connection with the labor transfer record.

## 2. Direct

A card whereon the order number shown is that of a productive order of the home department, should be entered in this block. It will be noted that there are two main columns shown in this block, as well as the two succeeding blocks, one headed "Amount," and the other headed "Piecework."

The object of this distinction is to separate day and piecework in order that the pay-rolls may automatically show how much of the direct labor is operating under daywork as against any special inducement method other than daywork. It might be noted here that the straight-time earnings under bonus work or any other kind of premium work should be also entered in the piecework column, this heading being used for any kind of work other than straight daywork.

## 3. Indirect

The indirect block is arranged exactly as the direct block. Entries to be made therein are confined to work performed by anyone in the department on any standing order number of the department. In other words, no work must be included which is done by the department on the standing order number of any other department or any general department. The entries must be confined wholly to work on the standing orders of the department of which the worker whose pay-roll sheet is being prepared is a member.

## 4. O. D. Standing Orders

"O. D. Standing Orders" means in full "Other Department Standing Orders," and is designed to cover the entry of any work performed by the department of which this employee is a member, on the standing order of any other department in the plant.

The work entered in the O. D. S. O. columns is of the same nature as that entered in the direct column, so far as the

originating department is concerned, and must be considered in conjunction with the direct in finding the basic figure for the burden rate.

An instance of this might occur in case a grinding department ground some tools for another department. To them this work is the same as work done for an outsider, and the department receiving the benefit should pay not only the direct-labor cost but also the burden in connection therewith. It is, therefore, exceedingly important to be certain that every entry made in the O.D.S.O. columns is for the work on other department standing orders.

In this connection it may be thought that many times a department might do work which would not carry overhead as against another department. In cases of this sort the entry should be carried out under the transfer scheme rather than through the O.D.S.O. scheme.

### 5. Total

The entries in the Total column consist simply of the total time and amount, and show the total earnings for each day, as well as the total time for each day. In this connection, it might be brought out that even though the time cards are supposed to have been verified by the dispatch clerk as to the total elapsed time for each day, the clock cards are brought to the pay-roll department at the close of the week for a final check against the time as shown daily on each man's pay-roll sheet, to doubly safeguard the accuracy of the pay records.

### Closing the Pay-Rolls

As each day of each man's time has been entered, the total time and amount has been brought out to the total column. At the close of the pay period the entire sheet is footed vertically in all its columns, and cross-footed to agree with the vertical footing of the total column. This makes an absolute

check on the accuracy of the time and money entries and is a valuable feature in connection with the technique of pay-roll accounting.

If bonus or premium systems are in effect, it is then in order to enter at the bottom of the pay-roll sheet the bonus or premium which is due each man, in case there is no special bonus or premium pay-roll sheet provided therefor. Deductions from the pay-roll which may be necessary on account of subscriptions, rent, liberty bond payments, or many other purposes, should then be entered. After these additions and deductions have been made, the net amount of pay for the man can be computed, and the pay envelope made out accordingly.

### **Splitting Pay-Rolls at Close of Month**

Many times when the pay-roll period is one week, the end of the month comes in the middle of a week. In such cases it is necessary to enter the cards of the last working day of the month and to rule footing lines after the entries of this day. The entries for the remaining days of the week are then made, and after all the entries are in for the last day of the week, another subfooting line is ruled in. It is then necessary first to add the sheets down to the first subfooting, and then the balance of the days of the week down to the second subfooting—each section separately. The two subfootings must then be added to arrive at the total for the week. The use of these subfooted totals will be explained later in this chapter.

### **Pay-Roll Totals**

The next operation is to arrive at the total of the pay-roll for each department. The procedure consists merely of adding the total time and amount of money for each block, whereby is shown the total for transfer, direct labor, indirect labor, O.D. standing orders, as well as the total pay-roll. Note that the totals are to be in both time and money.

This total must be arrived at for each individual pay period, but in addition to this a monthly total will be made up by recapitulation as follows.

The last subtotal of a split pay-roll at the beginning of the month starts the recapitulation for the month. The full pay-rolls during the course of the month are then taken, and to them is added the first part of the split pay-roll at the end of the month. This gives the exact total of the pay-roll during the current month, which then becomes the basis of the journal entries to effect the controls referred to in other chapters.

In this connection it should be stated that the total of the full week's pay-roll is the amount for which the pay-roll check is drawn and which credits cash and charges the pay-roll account. It will be seen by this that the credits which are made to the Pay-roll accounts because of transfers to the various control accounts are in advance of the payment of the last pay-roll, which in turn explains the reason for there always being in the balance sheet an accrued pay-roll in the liability section. Only the actual pay-roll of the month being figured is needed for control purposes.

### **Analyzing Pay-Roll Records**

After obtaining the totals for each department of the headings as shown on the pay-roll sheets for the entire month, the journal entry is prepared, crediting the actual pay-roll figures for the month to the pay-roll accounts, and charging the various control accounts involved.

In compiling this journal entry, all burden accounts for the various departments are grouped together in the order of the departments as they appear in the standing order code—all expense accounts in their order, and the Work in Process Labor account for each department in the same order as the burden accounts. Two other accounts will be shown in the



debit side of this entry, namely, an account called "Transfer" account, and one called "O.D.S.O. Clearance" account.

The method, then, of filling out the journal entry is to take each department's total of the various blocks as described, and enter it against the corresponding heading in the journal entry. Two exceptions to this are in the case of the Transfer account and the O.D.S.O. Clearance account, where it is necessary to recapitulate the debits to these accounts from all departments, combining them into one grand debit for each of these accounts.

Thus the total for each department of the direct block is entered opposite the work in process labor title for this department in the journal entry. The total of the indirect block is entered opposite the items showing debit to the burden account for this department. The total of the transfer for this department is combined with the total transfers of all other departments and entered opposite Transfer account in the journal entry. The O.D.S.O. block is handled in the same way.

The credits of this journal entry are the total of the total block for each department, which entry would be made against the credit item of the Pay-roll account for each department.

### **Result of the Foregoing Distribution**

It may be now easily seen that the journal entry as above described will debit the various control accounts which have been described in other chapters. (See Chapter XIX for the procedure which governs the crediting out of these costs in connection with the burden statements.)

### **Work Performed by One Department for Another**

At all times the cost man has been confronted by the knotty problem of how to dispose of time when men are loaned to another department for a longer or shorter period, or when work is performed in a department for another de-

partment on which the burden of the originating department should be charged.

It should be constantly borne in mind that the pay-rolls of each operating department must be maintained intact, or there will never be any known basis of the total direct-labor cost or labor hours on which to establish the control of the work in process labor or compute the burden. Nor will there be any accurate control of the indirect labor, unless the pay-rolls accurately represent what has transpired in connection with the men who are listed for each particular department.

There have been many ways of solving these problems, one favorite way, in the case of a loaned man, being to give the man a new check number in the department to which he was loaned. This has resulted, and might at any time result in his being paid double, as the two check numbers would automatically mean that he would have two pay envelopes.

A method is here presented for safeguarding the records without issuing a new check number. While perhaps appearing complicated on first consideration, it is quite simple when thoroughly understood.

### **Loaned Workers**

The procedure under this method, so far as it relates to the shop end, is described in detail in Chapter XV under the heading "Recording Time of Loaned Workers." From that description it will be seen that when a man is loaned from one department to another, his card, stamped with "Transferred to Department Number . . . ." is entered on his home pay-roll. All cards of this nature are entered on the regular pay-roll sheet for this man under the block heading "Transfer."

After the pay-roll entries for each day are made and proved up, the cards stamped with the transfer stamp are thrown out. They are then sorted according to the department to whom the workers were loaned. They are next footed for

each department which received the benefit of the loaned labor, and the total for each department is entered on the labor transfer record (Form 30) in the column headed "From" for the department which received the benefit of the work. Each of these entries will show the department which loaned the labor as well as the amount of money involved in the loan.

The department making the loan receives an entry for the total of all the labor loaned out for the day on its own labor transfer record sheet under the heading "To." The entry on this record is a single amount. No entry is necessary under the subtitle "Department," unless it should be desired to enter all the details.

It will be noted that by this method of entry, the total for the month under the heading "To" on each labor transfer record, should exactly equal the total of the transfer block on the pay-roll sheet for the same department.

At the close of the month all figures on the labor transfer records are footed for each department, and a journal entry prepared as follows: The debits are the total of the columns headed "From" on the transfer record of each department, and are entered in the journal as a debit to the Burden account of the department on whose sheet it appears. The credit is the total of all the transfer sheets of the figures under the heading "To," there being but one credit to the journal entry, namely, to the Transfer account, as explained in Chapter XIX. This credit should exactly equal the debit received from the pay-roll journal entry.

### **Other Department Standing Order Labor**

The problem in connection with the other department standing order labor is far more difficult and one which not only involves the labor expended by one department on the standing orders of another department, but in addition the burden on this labor. The handling of this class of charges,



however, is accomplished in somewhat the same manner as in the labor transfers.

The procedure is as follows: As in the case of the loaned workers, the cards charging other department standing orders, which are stamped with the rubber stamp in large letters "O.D.S.O.," are thrown out, after the pay-roll has been completed for the day and proved up. These cards are then extended with the proper burden for the department, and a super machine rate, if such exists. These extensions are made on each card with red pencil in the lower right-hand corner under the heading "Circle Last Number."

The cards are next sorted by the departments as charged, in exactly the same manner as the loaned labor cards were handled.

The cards for each department are then totaled for the total labor charge and also for the total burden charge, as shown by the red figures. The total for each department is entered on the O.D.S.O. transfer record (Form 31) in exactly the same way as in the case of the loaned labor in the columns headed "From," with the exception that in addition to the labor amount there is entered also the total of the burden charge.

The total of all the departments to be charged by the originating department is found and entered on the O.D.S.O. transfer record of the originating department under the heading "To," showing the labor and the burden separately.

At the close of the month a journal entry is prepared in practically the same manner as in the case of the labor transfers as follows: The total of the "From" columns for each department, including both labor and burden, is the debit to the Burden account of the department shown at the head of the record. This applies equally to each department and the result is a debit to each burden or expense account involved in the plant.

The credit side of this original entry, however, is radically different from that in connection with the labor transfer. The total of all the labor under the heading "To" is found and combined into one figure which is shown in the journal entry as a credit to the Other Department Standing Order Clearance account. This figure should be absolutely identical with the debit in the journal entry, which clears the pay-roll accounts and is made up from the pay-roll sheets, leaving this account with no balance.

[illegible]

**Form 31. O. D. S. O. Transfer Record. (Size, 8½ x 11.)**

The balance of the credit entry, however, consists of a credit to each departmental Work in Process Burden account, provided that an account of this nature has been set up for each department. If there is but one Work in Process Burden account for the entire plant, the credit naturally consists of only the one entry to this account.

This completes the journal entry, and has effected the transfer of the work done by the various departments for the other departments of the plant.

**Final Filing of Both the Labor Transfer and O.D.S.O. Cards**

Each day, after the entries have been made on the labor transfer record and the O.D.S.O. record, the cards in the transaction are filed under the standing order numbers as shown on the cards. It will be noted that these order numbers are all for departments other than the department where the men who performed the work belong, but as the money value has been transferred from the originating department to the departments which received the benefit of the work, it is now possible to file the cards under the standing orders where they belong. As a matter of record, no further thought is to be given to these cards, excepting to foot them into the various burden and expense accounts wherever they are found.

It may be repeated that the journal entries effecting this transfer reduce the labor costs of the originating departments to the amounts actually used by themselves on their own standing orders, and increase the control accounts of all other departments by the amount of labor and burden involved in the work which was done for them by departments other than their own.

## CHAPTER XVII

### CALCULATION AND APPLICATION OF DEPARTMENTAL BURDEN RATES

#### **Burden Subject to Scientific Calculation and Control**

No feature of cost accounting is more difficult than burden distribution. Burden has been the least understood and has received the least attention of all cost items, because of the wide-spread impression of its extremely elusive nature. In reality burden presents very great possibilities for saving. No longer is it regarded as a bugaboo in progressive plants. It can be calculated with a surprising degree of accuracy and can be scientifically controlled through the medium of departmental burden rates together with expense accounts and departmental burden accounts. A brief survey of the more important steps in the evolution of burden distribution will make it easier to understand the superiority of the departmental burden rate method.

#### **Evolution of Burden Distribution—1. Fixed Percentage Method**

What was probably the first method of distributing burden—known as the fixed percentage method—was arbitrary and for that reason inaccurate. Under this plan manufacturing cost was ascertained by simply adding, usually to the prime cost, a fixed percentage to cover manufacturing burden. To manufacturing cost was added another fixed percentage to cover selling and administrative burden. The addition to this cost figure of further percentages to represent profit, furnished the figures employed for the arbitrary fixing of selling prices.



Prices so fixed were satisfactory because competition was not so keen as it is today, because profits thus figured were deemed sufficient, and because income and excess profits tax laws had not literally forced manufacturers to realize the need of more accurate costs. Today the situation has changed and slipshod methods of cost accounting are not tolerated in progressive plants. But the evolution of accurate burden distribution has been gradual.

## **2. Blanket Rate Method**

The next step after the fixed percentage method was the use of blanket rates. This method increased the accuracy of burden incidence. At the beginning of each fiscal period, blanket rates were calculated for the period, based on either total direct-labor costs or total direct-labor hours for the whole plant during a past period or a future period. Material costs, prime costs, and machine hours were also used, occasionally, as burden bases. In other words, the rates were based on past figures or estimated figures. The blanket burden rate for each factory was calculated by dividing either the total direct-labor costs or total direct-labor hours on all jobs into the total manufacturing burden for all jobs. This blanket rate was then applied to either the direct-labor cost or direct-labor hours of each individual job according to the burden basis selected, in order to ascertain the burden cost of the job. If in a given case the estimates for total manufacturing burden and total direct labor costs were \$50,000 and \$100,000 respectively, the blanket rate or burden ratio would be 50%. This rate would be applied during the ensuing period to the labor cost of each job. Suppose a job had the following prime cost: Direct material \$1,000; direct labor \$3,000.

Its burden cost would have been \$1,500 ( $\$3,000 \times .50$ ). The sum of this burden cost (\$1,500) and prime cost (\$4,000) equaled the manufacturing cost of the job (\$5,500).

Both fixed percentages and blanket rates were open to serious objection. Neither method considered differences among productive departments with respect to equipment, labor hours, machine hours, labor costs, etc., which caused burden to vary for each department. Both methods ignored the fact that departments were the only natural units for the calculation and application of burden. Fixed percentages and blanket rates are being supplanted more and more by departmental burden rates.

### 3. Departmental Burden Rate Method

The next step in the evolution of burden distribution was the use of departmental burden rates. This method is generally regarded today as the best method of applying burden to product. The steps involved in the calculation and application of departmental burden rates and in the preparation of expense and burden statements may be summarized as follows:

1. Selecting equitable bases for the distribution of overhead to expense and burden accounts.
2. Current charging, through monthly journal entries, of actual burden incurred to expense and burden account.
3. Current closing, through monthly journal entries, of primary expense accounts into secondary expense accounts, which in turn are closed into departmental burden accounts, one departmental burden account being kept for each productive department.
4. Predetermining standard departmental burden rates.
5. Preparing monthly expense and burden statements.  
(See Chapter I for relation of terms: "expense," "burden," and "overhead.")
6. Applying standard departmental burden rates which charge Work in Process Burden accounts and credit Burden Credit accounts. The detailed charges for

- applied burden are entered on individual part cost sheets or assembly cost sheets as the case may be.
7. Transferring the burden balance of each productive department—which is the overabsorbed or under-absorbed burden—to the Profit and Loss account.
  8. Recording the net result of this summary account in the current Profit and Loss account as a deduction from or addition to the gross profit—as the case may be—before net manufacturing profit is ascertained.
  9. Preparing statements which show monthly comparisons of burden.
  10. Revising departmental burden rates when standard burden rates are no longer applicable to current conditions.

#### **Bases for Distributing Overhead to Expense Accounts**

The selection of equitable bases for the distribution of overhead expense and burden accounts is discussed in Chapter XVIII.

Expense and burden items may come directly from the voucher register through the expense debit slips, or through time cards and material requisitions. (For detailed accounting in connection with recording of expense, see Chapter V; see also the chart "Graphic Illustration of Flow of Cost Procedure.")

#### **Distributing Expenses to Departmental Burden Accounts**

After the journal entries distributing all labor through the pay-rolls, material through the requisitions, and expense items through the medium of the expense ledger and expense debit slips, have been completed, and the time slips, requisitions, and expense debit slips are properly filed under the proper standing order numbers, the making up of the various expense and burden accounts may proceed.

First of all, the class of expense accounts, such as Electric Power, Steam, Trucking, etc., which charge not only the operating burden accounts, but other expense accounts, such as General Office, Dining-Room Expense, etc., must be made up and distributed to the respective accounts on the bases explained in Chapter XVIII.

After these primary expense accounts are closed out, all other expense accounts will then be closed and distributed to the operating burden accounts.

All manufacturing overhead, therefore, must ultimately be collected in departmental burden accounts for productive—direct—departments. This cannot be done properly unless the most equitable basis for the distribution of current expenses incurred are selected. The use of the word “equitable” with little or no explanation has been a glaring shortcoming of much of our cost literature. The basis and methods of distributing burdens are discussed somewhat in detail in Chapter XVIII.

### **Predetermining Standard Departmental Burden Rates**

Before discussing the application of burden rates, the calculation of burden rates should be considered. The survey of a plant made by the cost accountant prior to the installation of a cost system may disclose the fact that the plant is not departmentalized, or that it is not departmentalized as well as it might be. If such a condition exists, proper departmentalization must naturally precede the calculation and application of burden rates, because burden rates are predetermined by departments. The survey may bring to light that a proper division of expense accounts does not exist and that equitable bases for distributing expenses are not used. These unsatisfactory conditions must also be corrected before burden can be scientifically applied and controlled. If proper departmental burden rates are not in use when the installation of the cost system

begins, then rates should be based either on past standard burden or on current burden during a period of sufficient duration to indicate what the standard burden should be. Burden rates, therefore, are averaged, predetermined, or estimated in advance of a fiscal period, and are then applied during current periods.

Burden rates should be standard or normal, i.e., they should be based on burden costs which occur when production is standard or normal. To determine standard or normal production, particularly in a seasonal business, is not always an easy matter, because it varies in different industries and in different plants in the same industry. According to some authorities, standard production occurs when the plant is running 80% to 90% of its capacity. This is a serviceable figure. It is obviously unfair to use burden rates based on a single month's actual burden unless such burden is typical of the whole year, which is seldom the case. For example, the repairs made to an open-hearth furnace in a steel plant may be unusually high one month and very low the next. It would be unfair, and hence inaccurate, to charge the product of the first month with a high burden rate and the product of the second month with a low burden rate; neither rate would be standard. Furthermore, proper selling prices cannot be fixed without standard burden rates. The price, no doubt, would be too high or too low. The use of a standard or average rate, however, is equitable for both estimating and cost purposes.

After the standard burden for a producing department has been ascertained, it is divided by some base, such as normal direct-labor hours, normal machine hours, or normal direct-labor cost—whichever basis best fits the conditions—in order to arrive at the predetermined burden rate for the department under consideration. Note that this rate is predetermined. If actual rates were used, product completed before the end of

the period could not be costed until the close of the period. Thus, one desideratum of cost accounting, namely, prompt compilation and presentation, would be lost if actual rather than predetermined burden rates were used.

### **Theory and Practice of Burden Calculation and Application**

The general theory underlying the calculation of departmental burden rates is that a proportional relationship exists between the burden of each department and some basis. The major problem, therefore, is to select the basis best suited to existing conditions. The same basis is not necessarily used for all departments. The most satisfactory bases for the calculation of departmental burden rates are:

1. Direct-labor hours
2. Direct-labor cost
3. Machine hours

Other bases, such as prime cost, sold-hour plan, overhead day, and list percentage plan, are either obsolete or of limited use.

Reference should be made to the discussion in Chapter XXXII of the advantages and disadvantages of the various methods of applying burden. In the following paragraphs only a brief reference will be made to the nature of the method of applying burden.

#### **1. Direct-Labor Hours Basis**

The direct-labor hours method is somewhat similar to the direct-labor cost method, except for the fact that the hours of labor applied become the basis for the application of the burden, rather than the amount paid for the hours. When this method is used, time must be carefully kept on all operations, no matter what the basis of payment may be, and an absolute total of all direct hours applied on productive orders

must be found and used in computing the rate per hour of the burden of the department. The amount of burden to be applied to each order will be the number of direct-labor hours charged to the order, multiplied by the standard rate per hour as predetermined for use in each department.

## **2. Direct-Labor Cost Basis**

Under the direct-labor cost basis, burden is applied to the product by means of a percentage on the direct-labor cost. This is done as follows: The total cost of labor applied to productive work is assembled. At the same time the total burden for the department is assembled. The latter figure divided by the former gives the percentage of burden to be applied to each individual order on the basis of the direct-labor cost which is known. This percentage is predetermined and is known as the standard burden rate. Actual burden and actual burden percentages are ascertained so that they can be compared with predetermined burden. Any great differences necessitate a revision of the predetermined rate.

## **3. Machine-Hour Basis**

The method of using machine hours as the basis for application of burden cost has been developed in many cases into such a complicated procedure, that the effect has been detrimental to the progress of the science of cost-keeping.

The machine-hour method is based on the theory that a portion of manufacturing burden should be applied to the work performed, on the basis of the time which each unit of production requires of the machines which are necessary to produce the goods. As to the justice of this contention there can be no question, and in the majority of manufacturing institutions this truth must be taken into account if the costs found are to be at all correct, and are to be regarded as safe for actual use.

On the other hand, to take all the manufacturing burden of the department into consideration on the basis of distribution through machine hours is not only erroneous, but is productive of an enormous amount of detail which succeeds only in beclouding the cost records from the point both of accuracy and of convenience for the management. Supervision, timekeeping, transportation of material around the shop, inspection, and many more of the items which make up a regular manufacturing burden, have really no relation whatever to the machine-hour basis. It would seem, therefore, to be going too far from the lines of sensible procedure to try to establish items in the machine cost which really have no purpose therein.

As a usual thing the items which are really involved in a machine rate are:

1. Depreciation on the machine unit.
2. Maintenance of the machine unit.
3. Power to operate the unit.

In many cases it is considered necessary to establish the fourth unit of interest on investment in the machine. This, however, is not advocated in this book, and certainly should never be done unless interest on investment is applied throughout all other operations of the business, as well as on a few exceptional machine units. Some other items may be included, such as insurance, etc., but these other items are usually so small that they really have no bearing on the eventual result.

It is, therefore, advocated that the machine-hour rates be confined to the items which really have a large bearing on the additional cost to be charged against production for the use of the machine units involved, and that the balance of the burden be handled through the use of the productive-hour rate as a general burden charge for the department. (See Chapter XXXII.)



The technique of determining a machine rate is not difficult; it is simply a matter of determining at the start the amounts to be allowed for proper depreciation, maintenance, and power, and then dividing this by, say, 80% of the total possible hours to establish the predetermined rate. Each month thereafter the actual depreciation, maintenance, and power will be known, and this should be divided by the hours which the machines actually run to arrive at a regular monthly figure as to the cost per hour for operating the machine. These figures will be compared monthly and will be a constant check on the standard rate being used.

### **Application of Departmental Burden Rates**

After standard burden rates are predetermined for each producing department, they are applied to each productive order during the current cost period. The number of direct-labor hours, or machine hours, or the direct-labor cost—which ever basis is used—of all the jobs in each producing department are multiplied by the departmental burden rates to give the applied or “earned” burden. The total of these applied burden figures is credited to departmental Burden Credit accounts and charged to Work in Process Burden accounts.

It should be stated at this point that two burden accounts for each productive department should be opened, although it is not always done. One account, known as “Department No. 1 Burden” account, shows the burden charges; the other, known as “Department No. 1 Burden Credit” account (see Chapter XXI), shows the burden applied through the medium of the departmental burden rate at the time when a Work in Process Burden account is charged for the same amount.

A question may arise as to the reason for using a Burden Credit account for each departmental burden account instead of crediting the latter itself with applied burden. The best reason is that the use of Burden Credit accounts insures

the accumulation of totals throughout the year, thereby facilitating the prompt preparation of statements. If, after charging the Work in Process Burden account the departmental Burden account should be credited with the applied burden of the department, only a net balance for the month would remain in the latter account. After the repetition of this process monthly throughout the year, the preparation of a progressive statement for the year would be troublesome.

If applied burden were credited to departmental burden accounts, extensive analysis of these accounts would be required before the firm could ascertain how actual burden and applied burden were running month by month. Examples of both accounts and necessary adjustments appear in Chapter XXI. The detail burden charges are applied to the costs of individual jobs on individual part cost sheets and assembly cost sheets. That is to say, the direct-labor hours, or machine hours, or direct-labor cost (whichever burden basis is used) applicable to a given job is multiplied by the departmental burden rate to give the burden cost of the job.

### Departmental Balances

Each departmental burden account is charged with the actual burden of the productive department concerned. The companion Burden Credit account is credited with burden applied at the standard rate for the department. Actual burden and applied burden are entered in the *burden statement* for the department concerned. Any difference between the actual and applied burden is entered in the burden statement and also in the profit and loss statement.

### Revision of Departmental Burden Rates

By use of departmental Burden accounts and Burden Credit accounts, actual burden can be readily compared with

applied burden. Any differences will be small if care is observed in setting standard departmental burden rates. A plant, for example, with an actual burden of \$2,000,000 had a total of only \$12,000 under-absorbed for the year. In other words, the undistributed burden for the year was only  $\frac{3}{5}$  of 1%, which shows what can be done with scientific control of burden.

If plant burden balances are large and liable to continue so, the burden rates should be revised to fit the changed conditions. Otherwise current costs will be inaccurate. Burden balances may be due, among other things, to changes in the volume of production or in burden costs, or to idle machinery and equipment. (See Chapters XXX and XXXI.)

## CHAPTER XVIII

### DISTRIBUTION OF EXPENSE ACCOUNTS

#### **Discussion of Expense Accounts**

In the history of cost accounting there has been a great divergence of both opinion and practice regarding the distribution of certain originating expenses, and a good deal of inaccuracy. When two different methods are used for identically the same distribution, one must be right and one must be wrong. The reader's attention is directed to certain underlying arguments which may be applied to the problem of the distribution of initial expenses.

Probably because the majority of manufacturing institutions, at least up to two or three years ago, distributed their indirect cost on the basis of direct-labor cost, a misconception arose as to the distribution of certain expenses of a business other than those of the actual operating department—whose burden cost, of course, should be accurately found.

Some of the expenses referred to will be found in any plant of average size. For instance, a plant will probably have a general superintendent in whose office will be an assistant general superintendent, two or three stenographers, and half a dozen clerks for various general purpose work. The plant may have also a cost department of, say, fifteen or twenty people who are keeping the costs, both direct and indirect, of the entire plant. In addition there will probably be a pay-roll department employing ten or fifteen persons who compile the pay-rolls for the entire plant.

In the past, all of this expense was thrown into one general account. That is still the practice in probably the majority of plants. In occasional cases there might be an

account for each division as specified above, but the procedure of distributing the expense to the operating Burden accounts would be the same. That procedure in the majority of cases consisted of prorating this general expense to the operating burdens on the basis of the direct-labor cost or the direct-labor hours of each department—a method which can be proved to be entirely inaccurate and unreasonable. It is, of course, easy and simple, but no more so than the correct way.

Probably the only reason that could be urged for this method of distribution is the mental effect of the fact that *after* the expense has reached the operating burdens it is applied in the cost sheets on the direct-labor cost or the direct-labor hour. The reasoning here involved, however, is entirely wrong. The general superintendent's office, the cost department, the pay-roll department, and all other such general departments, are concerned exactly as much with the indirect labor as with the direct. It takes just as much, if not more effort on the part of the general superintendent to regulate the indirect as the direct workers. Likewise, it is just as much work to account for the wages and cost of the indirect workers as for the direct workers. Therefore, the splitting up of this expense among the operating burdens on the basis of direct-labor cost or hours alone is entirely wrong. Department A, for example, may require eighty direct workers with only twenty indirect workers. Department B may be just the reverse, namely, a department in which the direct workers required are only twenty as against eighty indirect. A divergence as wide as that has been known to exist in many plants.

If the general expense accounts were distributed on the basis of the direct labor alone, department A would be charged four times as much for the general expense as would department B, and yet each department had the same number of men, all of whom had to be supervised and watched over by the general superintendent, accounted for by the pay-roll de-

partment, the cost kept by the cost department, and so on through whatever divisions are in like relation.

It should be quite evident, therefore, that the proper basis of distribution of those expense accounts should be on the basis of the *total* labor hours or *total* labor cost of each department.

This brings out very forcefully the fact brought out in other chapters, that too much attention cannot be given to the problem of properly departmentalizing the indirect operations whereby an absolutely and perfectly correct distribution of all these expenses may be made to the various burden accounts.

The problem connected with what might be called "super expense" accounts is entirely different from that involved in the burden accounts which are used directly in figuring the productive costs. (See Chapter XXXII.)

For this reason this chapter is set aside for descriptions of a few of the expense accounts, set forth in sufficient detail to illustrate what must be done, and to give enough clues as to the proper procedure to enable anyone to work out individual problems in his own plant.

### **Trucking Expense**

The trucking expense of a company is made up of charges for labor, the cost of gasoline, oil, etc., or of horses, the cost of repairs of the truck equipment and of the building which houses them, together with depreciation and other fixed charges which may apply.

It is easier to get the total cost than to distribute it and to establish a basic unit whereby the efficiency with which the trucking is handled may be checked. In many institutions the nature of the trucking is such that a tonnage basis is best. This applies particularly to some plants in large cities where all material is trucked to the plant, and the finished product away from the plant.

In other plants it is better to work on the basis of the trucking hour, that is, the actual number of hours of trucking performed. If this plan is followed, the trucks should be divided into classes, and the trucking hours found for each class. The point to be brought out, however, is that some cost basis should be established, both to show the quality of work performed and also to distribute the trucking expense to the departments affected.

### **Steam Expense**

This particular expense is quite difficult to control on the basis of unit of performance, unless a company goes to the expense of installing flow meters in order to know not only what is produced, but how the steam produced is distributed among the various departments. When steam is a very large cost, however, some steps should be taken to provide a basis for knowing production and distribution, even to the extent of installing flow meters; otherwise the consumption of steam as charged to various departments can only be estimated. Moreover, estimates give no check as to whether or not the amount of money spent on coal, etc., is justified.

### **Electric Power**

Plants which produce their own power naturally measure the amount of power produced, together with metered consumption of the various departments using the power, for a power plant today is so quickly out of date that means must be provided for a constant check on the cost per kilowatt hour, and also the amount consumed by the various departments as shown by actual measurement. In order to arrive at the basis of distribution, it is, of course, possible to go through the various departments and count the number of lamps, motors, etc., but such estimates are entirely inaccurate as the rated horse-power of a motor and the size of lamps must be taken

into consideration, with an estimate of the reasonable time the lamps and motors operate, to arrive at a figure which is at all usable.

On this basis of estimated consumption there is no check whatever on the waste which may be made of power, and the cost may be distributed to the various departments with the most careless inaccuracy.

### **Compressed Air**

The increased use of compressed air in connection with the operation of machines affords possibilities of enormous wastes unless some steps are taken to control its production and consumption. Steam leaks can be seen—like water leaks. Air, however, can leak without any check whatever. Very large sums of money may be wasted without anything to indicate that the air is leaking at perhaps every joint in the line.

Many plants have used compressed air with such prodigal abandon that the compressed air expense amounts to large figures before it is realized. For this reason it is urged that those responsible for the costs use every endeavor to check up the consumption and use of this commodity in those plants where it has become of general use.

### **Rent**

In those plants operating on a rental basis a number of things have to be taken into consideration in prorating the rent to the various departments. The square-foot basis is not sufficient, as for instance, in a foundry the building may be high and equal to four or five floors of the machine-shop section of the same plant. In fact, no specified rule can be laid down for the distribution of rent, since the proportionate value of the space used by the various departments is a matter of judgment. It is suggested, however, that when a company rents a plant they request from the owners a detailed



valuation of the various buildings. This, in many cases, would give a line on the valuation of various buildings and would be of assistance in prorating the rental as between a foundry building, machine-shop, or forgeshop. The latter would be higher than a machine-shop, but possibly not as high as a foundry.

Unfortunately the cubic foot does not entirely solve the problem, as naturally a foundry with a high roof does not cost as much as an equivalent height of building with three stories. On the other hand, it is fairly easy to take these things into consideration and prorate to the various departments the value of the space which they use. Without doubt, aside from buildings, such as foundries, forgeshops, etc., it is perfectly allowable to use the square foot arrangement for the normal shop of one floor in height.

### **Taxes**

In cases where plants are owned by the operators the distribution of taxes is somewhat along the same lines as rent, and is so closely allied that the comments made under Rent may very well apply to this heading, as far as buildings are concerned. Taxes on personal property should be distributed on the basis of the value of the equipment involved in the complement of each operating department.

### **Depreciation**

In a large measure the principles governing the distribution of depreciation, so far as buildings and plant facilities are concerned, are somewhat similar to the principles involved in distributing rent and taxes. The distribution of depreciation, however, is a far more important matter in that the largest consideration of depreciation is centered in the equipment used by each department, which in many cases may be very expensive.

Yet in a plant which has its appraisal of buildings and particularly of machine equipment, the problem is not difficult, as it then becomes a matter of fixing the depreciation on each unit and assembling therefrom the total depreciation for the department. This depreciation will, of course, be divided between buildings and equipment as the principles involved in each are separate.

Many pieces of equipment will have perhaps a depreciation of 25% because of their special nature, either as to delicacy of construction or because they quickly become obsolete. Other pieces of equipment may be subject to a depreciation of only 5%, as in the case of standard lathes and other machine tools which, with proper care, will be as good—as regards design—twenty years from now as at present.

The depreciation of buildings, therefore, should be on the basis of value of building used by each department, and depreciation on machine tools and equipment on the basis of the actual circumstances as stated above.

In all cases it is best to use what is called the "straight-line" method for recording depreciation—namely, a regular amount per month rather than a diminishing charge.

### Fire Insurance

This item should be distributed on the basis of the valuations made for insurance purposes. This basis is largely parallel to that which is used for depreciation of buildings and equipment. This would apply particularly in instances where the insurance rate is high.

In cases where plants are running under factory mutuals and have a very low rate of insurance, it sometimes does not pay to try to distribute the fire insurance on the basis of equipment, because of the fact that the insurance is a blanket proposition and the total expense for such insurance each year is very small indeed. In many cases of this sort the amount is

so small that the fire insurance is included in a general expense account and distributed with other items on the basis of total labor. It should be understood, however, that this is only in cases where the insurance cost is very small.

### **Liability and Compensation Insurance**

Unlike any other kind of insurance, liability and compensation insurance depends entirely on the amount of payroll paid out and also upon the classes of labor, as specified by the insurance policy. In this instance therefore—particularly inasmuch as this very distribution must be made for the auditor of the insurance company—the most simple and accurate method is to classify the pay-rolls of each department each month as specified by the insurance policy and ascertain the actual insurance which will have to be paid for each department.

With this classification, accurate figures of liability and compensation insurance expense can be obtained. It will also save a tremendous amount of work in classifying the pay-rolls at the end of the year, in order to satisfy the requirements for premium payment.

### **Telephone**

In most large institutions the telephone service involves a great deal of equipment, such as switchboards, extension instruments, special gongs, and other appliances. It has been found best to take all regular monthly charges for switchboard rental, extensions, etc., into one controlling account.

This account is distributed monthly through the journal as follows: The total cost of the telephone expense for switchboard, extensions, trunk lines, etc., is divided by the number of instruments actually connected with the board in the plant in order to establish a flat rate per instrument, including all regular monthly expenses. To determine the amount to be charged

to each department the rate should be multiplied by the number of phones used by the department.

Long-distance and toll charges should not be included in this computation but should be charged to the departments for whose benefit the calls were made. Such calls affect principally the sales department and the purchasing department.

### **Drafting Department**

Many problems arise in properly distributing the expense of a drafting department. For instance, owing to the varied nature of its work, the draftsmen sketch drawings for estimates for the sales department, make drawings for new equipment in the plant, make sketches for repair parts for the plant, sketch new building layouts, etc.

All that can be said within the space allotted here is that a method of time reporting should be installed in the drafting-room along the lines of the method used in a producing department. In other words, job numbers should be assigned to special work done by the draftsmen, and standing order numbers to regular routine work.

Those expenses of the department of a general nature which make up the overhead can be charged to the sales department, to new equipment, and all other points, on the basis of the time reported as shown on the records of work performed by the draftsmen.

### **Stores Expense Accounts**

In dealing with the various stores expense accounts, it may be found that one stores item may be entirely for the benefit of one particular department, another for the benefit of two departments, and another for the benefit of many departments. This must be taken into consideration when working up a distribution of the expense accounts of the various stores and of the general stores.

For instance, if it is thought best to have a complete store unit for some particular department, this expense naturally should be charged to that department. At the same time this department may also share in the expense of a general store-room as it is served by the general as well as its own store-room.

About the only basis for distributing stores charges is on the basis of total number of men in the departments served. This has exceptions in some plants where special storing facilities are provided for very valuable and special goods or for specially hazardous articles. The man basis, however, is as a usual thing, about the only practical one to use.

### **General Expenses**

It is urged that the title "General Expenses" be avoided and that the general expenses of the plant be split up into segregated expense accounts, such as Purchasing Department, Payroll Department, Cost Department, Statistical Department, General Superintendent's Office, Industrial Relations, Dining-Room Expense, House Publication Expense, and any other accounts which will quickly answer the question as to where the money in the general expense has gone.

In all the expense accounts enumerated above, it has been found best, as a general rule, to distribute same to the various operating burden accounts on the basis of the total number of men, the total labor hours, or the total labor value for each department.

## CHAPTER XIX

### PREPARATION OF JOURNAL ENTRIES

#### **Importance of Journal Entries**

Making journal entries is a most important part of the cost procedure leading to the monthly profit and loss account. After the various individual sections of the work are completed, the results of such work must be collected on summary sheets and cross-entries must be made to transfer the amounts involved in each operation from one set of controls to another. The following brief outline will make clear the steps in the progress of cost figures.

All purchase costs incurred must go through a voucher register as the book of original entry. That is, all purchases of labor, material, or any other item must go through the voucher register and be distributed thence to the specified control accounts.

All labor, after being first charged to certain pay-roll accounts, is distributed to other accounts through the medium of the pay-roll analysis, backed up by time cards.

All purchases of material are distributed as follows:

1. That which goes into stock and is subject to requisition, is charged to certain material inventory accounts, which in turn are analyzed by the stock records.
2. That which goes direct into expense accounts will be charged in the voucher register to the Expense Ledger account, which in turn is further analyzed and distributed to the various expense accounts by use of expense debit slips.
3. Miscellaneous expense items covering many kinds of intangible amounts paid for services, such as Legal Service and Mechanical Service, and many other items which are

chargeable to expense accounts will also be charged to the expense ledger and distributed through the medium of the expense debit slip as in (2).

4. Certain items, such as Insurance, Taxes, etc., which are prepaid in considerable volume, should be charged to so-called "Prepaid" accounts subject to monthly distribution through the medium of standard journal entries.

5. Certain items, such as interest, and other items which are chargeable direct to certain expense accounts, but which are not of sufficient volume to warrant a column, are posted directly from the voucher register, rather than run through the Expense Ledger account. Such items are properly administration items which it is not desirable to put through the cost department.

6. In addition to the foregoing, journal entries are made to distribute the sales which have been entered on the sales records.

### **Voucher Register**

The voucher register is the largest distributing medium in the set of accounts, even though in late years the number of columns has been cut down and the use of subsidiary distribution sheets developed in order to reduce the size of the main book (see Chapter V).

It is allowable to post the entries from the voucher register in one of the two following ways:

1. After ascertaining the subanalyses, such as the pay-roll and material accounts specified in Chapter V, such analyses may be copied into the voucher register, thereby showing a complete analysis on the last page of the monthly record to be distributed. If desirable, the posting to the general ledger can be made direct from these figures.

2. Instead of copying the detailed analysis on the last page of the month's entries in the voucher register, this detail may

be copied in the general journal and posted to the ledger from that point.

The journal entry method is preferable—even though it involves a little more work—because it concentrates in the general journal all the distributions of the various books of original entry.

### **Cash Disbursements and Receipts**

The same may be said of the cash disbursement totals for the month as was said in relation to the voucher register. The journal entry should be made in the general journal and the postings made from there.

There should be very few entries from this book, as the burden of distribution should be placed on the voucher register.

The comments made as to cash disbursements apply equally to cash receipts.

### **Sales Records**

There are many ways of recording the sales of a company, and the procedure relative to journal entries for sales depends very materially on the method used for recording sales.

In many industrial lines it is best to have a regular sales ledger in which each sale is entered and distributed according to the sales accounts. The sales ledger should contain proper columns with provisions for postings for transportation, etc., and with a column for the cost of the sale.

In the majority of industrial institutions today, however, the volume of sales is usually too large to permit of this method of treatment. Instead, a numerical file of one or more copies of each invoice is assembled in binder as the sales record. This method is made possible by the use of adding machines upon which total sales under the various sales divisions, together with all items of postage, freight, etc., which



enter in, can be easily figured. Sales for the month are then distributed from a set of adding machine strips or sheets.

In all cases, what is known as a "top sheet" is prepared which gives the total sales as represented by the sheets in the binder, together with the total prepaid postage, freight, etc., involved in the billings. In some cases postings are made direct from these top sheets to the general ledger accounts, but it is best, as with other books of original entry, to copy this entry into the general journal and from there to the general ledger.

### **Labor Distribution**

From the voucher register, distribution of moneys paid out for labor is made to a pay-roll account for each department. These accounts constitute what is known as the original pay-roll and are subject to analysis through the medium of the pay-rolls in order to establish the controls needed for the operation of monthly profit and loss accounts.

The analysis of the pay-roll is discussed in Chapter XVI. Here, therefore, it is necessary only to point out that after the analysis of the pay-roll of each department for each month is completed, a journal entry must be prepared, crediting the Pay-roll account with the total pay-roll for the given month and debiting the control accounts which are affected by the distribution as found by the pay-roll analysis and as explained in Chapter XVI. It is best not to make an individual journal entry for each department, but instead to make one large journal entry for all the labor distribution, crediting all the pay-roll accounts and debiting the control accounts which cover the Work in Process Labor, the various expense accounts, the various burden accounts, the "Other Department Standing Order Clearance" account, and the "Transfer" account. The data for these entries is easily obtained if distribution of the pay-rolls is carried out. .

**Distribution of Material on Requisitions**

The preparation of data for journal entries in connection with material is on a different basis from that in connection with labor.

It must be remembered that the basic distribution to the various control accounts of all material drawn from stock-rooms on requisition must be made before these requisitions are filed under the accounts to which they are charged. Therefore it is important that the procedure here outlined be carried out.

After the material requisition slips have been received from the storerooms with all data properly filled in, and have been entered on the stock records so as to show the price and the number or name of the ledger account which holds the value of the material issued, the cost department proceeds as follows:

1. All requisitions are sorted daily according to the controlling inventory accounts which hold the value of the material used.
2. After sorting, the requisitions are footed and the total amount to be credited to each material inventory account is found.
3. These totals are then entered on an accumulation sheet which is simply a columnar-ruled analysis paper with the name of an inventory account at the head of each column.
4. Each requisition is then stamped with a rubber stamp "Credit Footing."
5. The requisitions are then sorted again into piles which represent the control accounts to which they are charged, namely, the various expense accounts, burden accounts, and Work in Process Material accounts.

6. After sorting, they are footed in order to ascertain the total debit to each of these controlling accounts and entered on another accumulation sheet whereon is a column headed with each expense, burden, or work in process account.
7. After these footings have been made each requisition will then be stamped with a rubber stamp "Debit Footing."

These two accumulation sheets representing the credit and debit entries should at all times be exactly balanced and should be kept continually under this proof.

With these steps completed, the requisitions are filed under their proper order numbers to permit constant closing of production orders and to be ready for the closing of the expense and burden statements at the end of the month.

The preparation of the journal entry then becomes a matter simply of taking the column totals from the credit and debit accumulation sheets. This transfers from the material accounts to the expense, burden, and work in process accounts the materials drawn out on requisition and leaves a true balance of the value of material on hand in each material inventory account.

### **Distribution of Expense Ledger Charges**

The use of the Expense Ledger account and the expense debit slip has been discussed already in Chapter V. It is necessary, however, to compile the figures carefully and to journalize the expense charges properly, if proper controls are to be maintained.

The expense debit slips are made out daily according to the charges to the expense ledger. Before filing the slips under their order numbers—which it must be remembered are only the expense or burden standing orders—an accumulation must be made as in the case of the material requisitions. The

difference is that in this case there is only a single credit—to the Expense Ledger account. In order to prove up daily, the accounting department should furnish the cost department with the totals for the day which are covered by the expense debit slips turned over to the cost department. The procedure is as follows:

1. Upon receipt of the expense debit slips, the cost department sorts them according to the controlling expense and burden accounts, and finds the total chargeable to each of these accounts.
2. These totals will be entered on an accumulation sheet similar to that used for requisitions where each control account has its accumulation column. One column of this sheet may be used as the credit column, in which will be entered the daily total as given by the accounting department, representing the total charge made daily to the Expense Ledger account. This sheet must be kept in balance daily as in the case of the material requisition distribution.
3. After this footing is completed, the debit slips will be stamped with a rubber stamp "Debit Footing" and the slips filed under the order numbers to which they are charged.

At the close of the month it is, therefore, a simple matter to prepare the journal entry debiting the various expense and burden accounts and crediting the Expense Ledger account.

It will be noted that the credit to the Expense Ledger account should exactly clear this account of all charges made to it during the month. That consummates in an orderly and accurate manner the direct charging of expense items which in the past has been a source of numberless errors in the handling of cost records.

### **Closing Expense Accounts**

As has been explained in other chapters, the closing of expense accounts is accomplished through the medium of journal entries after all the charges which belong to each expense account have been collected in the place where they belong.

The initial expense accounts, such as Power, Steam, Trucking, etc., should be figured completely and journal entries made on the basis of the distribution which has been decided upon, charging another set of expense accounts affected, such as General Superintendent's Office, Industrial Relations, and the Engineering Department, and the various burden accounts. After this distribution has been decided upon, the preparation of the journal entries is a very simple matter—charges being made to expense and department burden accounts and credits to the controlling accounts which hold the expenses being distributed.

After the initial expense accounts mentioned above have been distributed, and on the basis explained in Chapter XVIII, the next set of expense accounts as mentioned above is closed. These accounts, being then complete as to their costs, will themselves be distributed on the proper basis and a journal entry made out for each one, debiting the burden accounts. In these cases the credit for each account will be to its own control and the debits to whatever burden accounts receive a portion of its charges.

When this is complete all the initial and secondary expense accounts have been entirely wiped out and journalized to the operating burden accounts.

### **Burden Accounts**

In the case of the burden accounts, no journal credits are made to the burden accounts proper excepting at the end of a year. This set of accounts is the final showing of all the in-

direct costs of the plant, which are applied to the product on the basis of standard rates predetermined at the beginning of the period.

On the other hand, it is necessary to journalize the amount of burden which is to be applied to productive orders, for two reasons :

1. To constitute an account which will control the amount of burden at standard rates which is applied to productive orders.
2. To constitute an account which shall be used in the balance sheet as the inventory value of the burden on uncompleted orders in the shop.

Therefore for each burden account there should be provided an account called the "Burden Credit" account, as explained in Chapters XVII and XXI.

If the Burden account were credited, all control for statement purposes would be lost, and a continuous comparison of burdens throughout the year would be impossible.

Therefore the credits to each operating burden account should be placed in the Burden Credit account, in order to leave the Burden account free for adjustments only and to accumulate each month the actual burden incurred as the year goes on. This applies equally to the Burden Credit account, which should receive credit each month for the applied burden at the standard rate.

In order to prepare the journal entries for each month, the basic figures to be used in this journal entry are ascertained from the pay-roll distribution. As explained in Chapter XVI, the pay-rolls give us the total labor hours applied to the productive orders in each department; or, in case the labor value is used, they will give us the total value applied to these orders. The same applies to machine rates if the whole department is on machine time, and if not, the machine hours

will come from subsidiary records obtained from the time cards as the basis of the machine time applying to orders.

In either case, the total of the base for which burden is applied for the entire month in question is first ascertained. Then a credit journal entry is prepared for each burden account, which will be the total number of base unit hours—or whatever is used—times the standard rate used for computing the burden. This gives the total credit for the month for burden applied to the production orders. It is best to prepare one large journal entry wherein all departments are combined, showing a debit to each Work in Process Burden account and a credit to each Burden Credit account, as explained above.

The difference between the Burden Credit and the Burden account is not actually journalized until the end of the year, but in making up the profit and loss statements during the year this balance is shown on the burden statements and is carried to the profit and loss statement in order to compare the statement of profit and loss for each month. If the number of departments should be too great to carry all of these balances to the profit and loss statement, an intermediate collection may be made of all these balances on a separate statement called "Plant Balances." In this case, only the net result of all the Burden accounts is carried to the profit and loss statement, showing the final results as to over- or under-absorbed burden for the operating departments.

### **Prepaid Items**

It has been mentioned that in the distribution of the voucher register certain items, such as fire insurance, taxes, depreciation, etc., are charged to the prepaid accounts, subject to standard journal entries each month.

In each of these cases there should be a standard monthly entry for each item, subject to variations according to the change of basic conditions. For instance, depreciation is fig-

ured as suggested in Chapter XVIII; the amount to be distributed to each department is figured as suggested in Chapter XVIII; and each department is charged with its share of depreciation each month in this standard manner—excepting when equipment may be added or subtracted or the space of a department increased or decreased. The same applies to taxes and other accounts of like nature.

In all of these cases, preparing the journal entry is very simple, the same entry being made month after month excepting when changes as above mentioned become necessary.

### **Completed Production Orders**

The preceding journal entries have brought the accounts controlling operations into three main accounts, as follows:

1. Work in Process Labor
2. Work in Process Material
3. Work in Process Burden

If at all possible it is unquestionably best to have one of each of the above work in process accounts for each operating department, although in many cases this involves too much detail, and in other cases is impossible. In this connection it may be stated that the names of the work in process accounts given above are subject to considerable broadening when it becomes necessary to have special kinds of work in process accounts in order to control clearly and concisely the operations of the plant.

As production orders are completed, the accounts belonging to the three above-mentioned main classifications receive credit for the cost of the orders which are completed, and the various other accounts are debited as hereafter described.

The adoption of the best method of handling the detail work will aid greatly in accumulating the figures upon which journal entries are based. For instance, if a sales book is



used in which each sale is entered, columns may be provided to represent the cost of the sale, together with the work in process accounts which would receive credit for the cost. This, however, occurs in very few cases as it is usually better to work by a different method.

Probably in the majority of cases, work which is completed in the shop is charged daily to a Finished Stock account, and in such cases it is necessary to do one of two things.

1. To maintain an accumulation sheet for all completed orders, which sheet will show the work in process accounts to be credited and the various finished stock accounts to be debited, as well as the sales cost accounts to be charged if the debit of cost is to be made direct to cost of sales.
2. To file a duplicate of each cost sheet and at the end of the month recapitulate, by the use of electric or manual adding machines, the credits and debits involved.

As stated before, it is usually best to pass all completed orders through a finished stock account as this greatly simplifies all work in connection therewith. It is, therefore, recommended that an accumulation sheet of completed orders be maintained for each operating department. Then as the cost sheets are completed each day, either for individual or assembled parts, they should be footed for credits to the proper work in process accounts of the department and also for debits to whatever finished stock account is to be charged with the material. As this accumulation sheet will be carried on for the month and must be kept in balance, the making of the journal entry crediting the control accounts and debiting the cost accounts is simply a matter of copying the totals as shown by the sheet. It should be remembered, however, that the accumulation sheet must be kept in balance.

It often happens that a department does a great deal of work which never goes into a stockroom. In such cases the work should be charged out immediately upon completion. This can be handled on an accumulation sheet for completed orders, provided there be added to the debit side of the accumulation sheet columns representing the cost of sales accounts which will hold the cost of the goods which have been charged out.

Great care must be taken in this respect, however, as confusion is very easy. Goods which are supposed to be charged out direct find their way through a storeroom and become mixed in with that material which must be extended with its proper cost for credit to the finished stock account when shipped.

### **Finished Stock**

In probably the great majority of manufacturing institutions material is manufactured and passed through the stage of finished stock. The debits to the finished stock accounts come through the journal entries just described.

To arrive at the journal entries necessary to credit the finished stock and charge the various cost of sales accounts, the finished stock record-keeper must be provided with a copy of the shipping order or of the invoice to account for the finished stock, to use as the medium for pricing the cost of the sale. Whether a copy of the shipping order or a copy of the invoice covering the shipment is used, depends largely on the system in effect in each particular plant. In any event, it must be a document which permits of quick action in supplying a record to the finished stock record-keeper in order that he may quickly credit out and price the stock.

When journal entries are prepared in this case, the document representing the shipment is priced at its proper cost and recapitulated daily on an accumulation sheet. This sheet will

show the various cost of sales accounts which hold the cost of the sales made, there being a cost of sales account for each sales account. There will be as many debit columns on the sheet as there are sales accounts and as many finished stock columns as there are finished stock accounts.

As in other cases, this accumulation sheet must be kept in balance. The making up of the journal entries is then simply a matter of taking the totals from the accumulation sheet and crediting the finished stock accounts and debiting the cost of sales accounts.

### **In General Regarding Journal Entries**

It cannot be impressed too strongly that the accuracy of cost records depends entirely on the proper transfer of figures as the work progresses from one stage to another. With the careful journalizing of all steps, based on the data which come from accurately working shop conditions, it is entirely feasible to maintain through the control accounts a monthly profit and loss statement and balance sheet which are even more accurate than those based on an annual inventory. The whole procedure is based on the recording of all cost items, such as labor, material, etc., as they are incurred rather than waiting to see what is left at the end of the year after the money has been paid out—as was the case under the old methods of compiling annual profit and loss statements.

No industrial institution can live today without a close check on all of its operations, and it should be evident to anyone who will carefully study the progressive steps outlined in this chapter that, with the care which should be given to every operation in an industrial plant, figures can be produced which will be of incalculable benefit to the management. Warning is given, however, that the proper journalizing of the principal steps must be carried out strictly, in order to establish proof of all figures used in the compilation and statement of costs.

The slightest relaxation in accuracy will probably result in erroneous figures which cannot but prove disastrous.

On the other hand, continuous figures showing every month exactly how work is progressing may save the company from disaster. If it should enter on a dangerous road it will not have to wait till a year passes before discovering the fact.

## CHAPTER XX

### ILLUSTRATIVE LEDGER ACCOUNTS AND JOURNAL ENTRIES

#### **Scope of the Chapter**

To specify general ledger control accounts and journal entries to fit every case is, of course, impossible. On the other hand, the fundamental principles underlying the establishment of control accounts and the making of journal entries each month are practically the same in all lines of industry.

This chapter presents a set of general ledger accounts for an average foundry, followed by the usual journal entries which would be involved in handling the cost records. No space is taken up with illustrating the journal entries from the general books of entry, as this matter should be entirely familiar to everyone reading this volume.

The schedule of ledger accounts shown herein, and also the schedule of journal entries which follow the ledger accounts, are taken from the "Standard Foundry Cost System," published by the American Foundrymen's Association.

#### **General Ledger Accounts for Average Foundry**

The schedule of general ledger accounts in the following pages is such as would be required to reflect the details of an average foundry. Subaccounts or additional accounts should be added to represent classes of transactions special to any particular foundry. The schedule and definitions are merely illustrative of the principles involved.

The accounts appear under the following groups which are in the sequence required for presentation on the balance

sheet and profit and loss statement, which sequence is important in order to facilitate the work of preparing the statements.

1. Current assets.
2. Inventory assets.
3. Fixed assets.
4. Deferred assets.
5. Intangible assets.
6. Current liabilities.
7. Fixed liabilities.
8. Reserves.
9. Capital liabilities.
10. Surplus and profit and loss accounts.
11. Financial profit and loss accounts.
12. Operating expense accounts.
13. Sundry general ledger accounts.

The following detailed accounts are suggested for the general ledger. These may be amplified as much as desired, or as the business demands.

**1—Current Assets:**

- 1—Cash in bank (an account for each bank).
- 2—Petty cash.
- 3—Notes receivable.
- 4—Accounts receivable.
- 5—Bonds and other investments.

**2—Inventory Assets:**

- 1—Melting stock metals.
- 2—General stores (or as many as desired).
- 3—Finished castings.
- 4—Work in process.

**3—Fixed Assets:**

- 1—Machinery and equipment.
- 2—Real estate and buildings.

**4—Deferred Assets:**

- 1—Unexpired insurance.
- 2—Unexpired taxes.
- 3—Prepaid interest.

**5—Intangible Assets:**

- 1—Patents.
- 2—Good-will.

**6—Current Liabilities:**

- 1—Notes payable.
- 2—Accounts payable.
- 3—Accrued pay-roll.
- 4—Accrued taxes.
- 5—Accrued commission.
- 6—Accrued interest.

**7—Fixed Liabilities:**

- 1—Bonds payable.
- 2—Mortgages payable.

**8—Reserves:**

- 1—Reserve for depreciation on machinery and equipment.
- 2—Reserve for depreciation on buildings.
- 3—Reserve for bad debts.

**9—Capital Liabilities:**

- 1—Capital stock—preferred.
- 2—Capital stock—common.

**10—Surplus and Profit and Loss Accounts:**

- 1—Surplus.
- 2—Income and excess profits account.
- 3—Dividends—preferred stock.
- 4—Dividends—common stock.
- 5—Profit and loss.
- 6—Adjustment account.
- 7—Castings sales.
- 8—Cost of castings sales.
- 9—Miscellaneous sales.
- 10—Cost of Miscellaneous sales.
- 11—Freight out on sales.
- 12—Administrative expense.
- 13—Selling expense

**11—Financial Profit and Loss Accounts:**

- 1—Interest received.
- 2—Discount taken.
- 3—Interest paid.
- 4—Discount given.
- 5—Interest or dividends on investments.

**12—Operating Expense Accounts:**

- 1—Cost of melt.
- 2—Cost of melt credits.
- 3—Molding burden—direct labor.

- 4—Molding burden—direct labor credits.
- 5—Molding burden—machine hour.
- 6—Molding burden—machine hour credits.
- 7—Molding sand cost.
- 8—Molding sand cost credits.
- 9—Flask cost.
- 10—Flask cost credits.
- 11—Coremaking burden—direct labor.
- 12—Coremaking burden—direct labor credits.
- 13—Coremaking burden—machine hour.
- 14—Coremaking burden—machine hour credits.
- 15—Finishing cost.
- 16—Finishing cost credits.
- 17—Annealing cost.
- 18—Annealing cost credits.
- 19—Power, heat, and light expense.
- 20—Pattern-shop expense.
- 21—General expense.
- 22—Expense ledger.

13—*Sundry General Ledger Accounts*

1—CURRENT ASSETS

(1-1)—*Cash in Bank:*

*Debits—*

- (1) Open the account with the amount of cash in bank;
- (2) Total amount of cash deposited during the month.

*Credits—*

- (1) Total amount of checks issued during the month.

*Balance—*

Represents the value of cash in bank at end of month. Should be reconciled with the bank's statement to determine outstanding checks and uncredited deposits.

(1-2)—*Petty Cash:*

*Debits—*

- (1) With the value of checks drawn to create or to increase the amount of cash on hand to cover petty expenses for a short period.

*Credits—*

- (1) With any decrease in the amount on hand.

*Balance—*

Represents the amount set aside for petty cash disbursements.

(1-3)—*Notes Receivable:*

*Debits—*

- (1) Open the account with the face value of promissory notes.



- (2) Notes and acceptances received;
- (3) Notes renewed.

*Credits—*

- (1) Payments on notes receivable and acceptances;
- (2) All notes and acceptances sold or otherwise disposed of;
- (3) All notes renewed.

*Balance—*

Represents the value of all notes receivable and acceptances on hand.

**(1-4)—Accounts Receivable:***Debits—*

- (1) Open the account with the total of individual customers' accounts in the accounts receivable ledger;
- (2) The total charges to customers as represented by postings on sales register.

*Credits—*

- (1) Total payments received from customers, whether cash, notes or acceptances;
- (2) Allowances to customers, including cash discount; in other words, the gross settlements with customers.

*Balance—*

Represents the net amount due from customers.

**(1-5)—Bonds and Other Investments:***Debits—*

- (1) Open the account with the market value of stocks and bonds on hand;
- (2) Market value of other investments;
- (3) Cash value of life insurance policies, etc.;
- (4) Cost of all stocks, bonds and other investments purchased.

*Credits—*

- (1) Cost of stocks, bonds and other investments sold at value carried (any sales of securities at other than the value carried will necessitate entry of the profit or loss to an account representing profit and loss on sales of investment securities).

*Balance—*

Represents the cost value of stocks, bonds, and other investments owned by the company.

**2—INVENTORY ASSETS****(2-1)—Melting Stock—Metals:***Debits—*

- (1) Open the account with the cost value of all melting stock or metals on hand;
- (2) All purchases of melting stock metals;

- (3) Transportation charges on incoming melting stock metals (distributable according to corresponding invoices);
- (4) Charges for unloading in the case of a long-term supply;
- (5) Returns to stores of melting stock from melting department.

*Credits—*

- (1) All withdrawals of melting stock metals as represented by monthly summary of metals used;
- (2) All melting stock returned to vendors.

*Balance—*

Represents the value of melting stock metals on hand; should agree with the aggregate of the individual stock ledger sheets or cards.

*Note:—*The following subdivisions may be maintained:

1. Pig iron.
2. Purchased scrap.
3. Foundry scrap.
4. Ferromanganese.
5. Ferrosilicon.
6. Other melting stock as required.

(2-2)—*General Stores:*

*Debits—*

- (1) Open the account with the value of all general stores material (i.e., other than melting stock metals) on hand;
- (2) Purchases of additional material;
- (3) Transportation charges on incoming general stores material (distributable according to corresponding invoices);
- (4) Returns to stock of general stores material.

*Credits—*

- (1) Withdrawals of general stores material from stock as represented by monthly summary of materials used;
- (2) Material returned to vendors.

*Balance—*

Represents the book value of general stores material on hand; should agree with the aggregate of the individual stock ledger sheets or cards.

(2-3)—*Finished Castings:*

*Debits—*

- (1) Open the account with the physical value of all finished castings on hand;
- (2) Deliveries of finished castings as represented by the summary of closed production orders—at cost;
- (3) Returns of good material from customers.

*Credits—*

- (1) Material shipped during the period.

**Balance—**

Represents the cost value of finished goods on hand.

**(2-4)—Work in Process:****Debits—**

- (1) Open the account with the cost of goods in process;
- (2) With the total amount of molding productive labor and coremaking productive labor as represented by the summary of time cards on pay-rolls;
- (3) With cost of melt for the month at predetermined rate;
- (4) With proper portion of following expense accounts at predetermined rates:
  - a. Molding burden—direct labor,
  - b. Molding burden—machine hour,
  - c. Molding sand cost,
  - d. Flask cost,
  - e. Coremaking burden—direct labor,
  - f. Coremaking burden—machine hour,
  - g. Finishing cost,
  - h. Annealing cost;
- (5) With cost of castings returned by customers (if finished castings account is not carried).

**Credits—**

- (1) Cost of castings shipped, if finished castings account is not carried, otherwise with cost of finished castings delivered to finished castings stores;
- (2) Scrap value of bad castings and sprues returned to melting metals stock;
- (3) Losses due to defective work or other errors in service distributable to the departmental expense involved.

**Balance—**

Represents the cost of finished castings on hand and in process (if finished castings accounts is not carried), otherwise of castings in process.

**3—FIXED ASSETS****(3-1)—Machinery and Equipment:****(3-2)—Real Estate and Buildings:****Debits—**

- (1) Open the accounts with the first cost or replacement value of all permanent plant investment represented by the respective accounts;
- (2) All expenditures for permanent additions.

**Credits—**

- (1) Value of fixed assets sold or otherwise disposed of.

**Balance—**

Represents the book value of fixed assets against which as offsetting accounts are the respective reserves for depreciation.

**4—DEFERRED ASSETS****(4-1)—Prepaid Insurance:****Debits—**

- (1) Open the account with the amount of unexpired insurance premiums;
- (2) Subsequent insurance premiums.

**Credits—**

- (1) Periodical charge equivalent to pro rata insurance cost for period;
- (2) All refunds and cancellations.

**Balance—**

Represents unexpired insurance premiums.

**(4-2)—Prepaid Taxes (If prepaid. See 6-4):****Debits—**

- (1) Open the account with total of unexpired taxes paid in advance;
- (2) Subsequent taxes paid in advance.

**Credits—**

- (1) Amount equivalent to one-twelfth the annual tax to effect liquidation of monthly charge to taxes in the various expense groups.

**Balance—**

Represents taxes paid in advance.

**(4-3)—Prepaid Interest (See 6-6):****Debits—**

- (1) Open with balance of prepaid interest;
- (2) All subsequent prepaid interest.

**Credits—**

- (1) With monthly proportions of interest accrued as to the items entered in this account as prepaid.

**Balance—**

Inventory of unused prepaid interest.

**5—INTANGIBLE ASSETS****(5-1)—Patents:****Debits—**

- (1) Open the account with the estimated value of patents owned;
- (2) Cost of acquiring subsequent patents including all incidental expenses.

*Credits—*

- (1) Pro rata amount equivalent to one-twelfth the annual charge for the extinguishment of patents. (If so treated.)

*Balance—*

Represents the book value of patents owned.

**(5-2)—Good-Will:***Debits—*

- With value of good-will.

*Credits—*

- With any depreciation of good-will.

*Balance—*

- Net value of good-will as carried.

**6—CURRENT LIABILITIES****(6-1)—Notes Payable:***Debits—*

- (1) Payments reducing the notes payable.

*Credits—*

- (1) Open the account with the value of all outstanding notes payable;
- (2) All subsequent notes issued.

*Balance—*

Represents the amount owed by the company on notes payable.

**(6-2)—Accounts Payable:***Debits—*

- (1) Payments of accounts payable;
- (2) With all contra charges to vendors' accounts;
- (3) Value of material returned to vendors for credit;
- (4) With amount of notes given vendors;
- (5) With all trade or cash discounts allowed by vendors and earned.

*Credits—*

- (1) Open the account with the total of vendors' or purchase creditors' accounts;
- (2) Total credits to accounts payable on the purchase journal.

*Balance—*

Represents the net amount owed to creditors on open account.

**(6-3)—Accrued Pay-Roll:***Debits—*

- (1) Amount of wage and salary payments made during the period as represented by cash book entries;
- (2) With amounts paid as bonus.

*Credits—*

- (1) Amount of wages, salaries and bonus earned.

**Balance—**

Represents pay-roll amounts accrued but unpaid.

**(6-4)—Accrued Taxes (If accrued. See 4-2):****Debits—**

- (1) Actual payment of taxes.

**Credits—**

- (1) Monthly amount charged to operating expense.

**Balance—**

Represents accrued amounts of taxes accumulated but not yet due.

**(6-5)—Accrued Commissions:****Debits—**

- (1) Commissions actually paid agents or sales representatives.

**Credits—**

- (1) All accrued commissions on sales billed (or orders taken) during the period, charging selling expenses.

**Balance—**

Represents commissions accrued but not paid.

**(6-6)—Accrued Interest (See 4-3):****Debits—**

- (1) With interest paid as to items entered herein as accrued.

**Credits—**

- (1) Open the account with the amount of accrued interest unpaid;  
(2) With amounts accrued monthly on items if interest is accruing.

**Balance—**

Represents accrued interest on items payable accumulated but not yet paid.

**7—FIXED LIABILITIES****(7-1)—Bonds Payable:****Debits—**

- (1) Payments reducing bonds payable.

**Credits—**

- (1) Open with balance of all outstanding bonds;  
(2) With all subsequent issues.

**Balance—**

Represents outstanding bonded indebtedness.

**(7-2)—Mortgages Payable:****Debits—**

- (1) Payments reducing the principal of mortgages payable.

**Credits—**

- (1) Open the account with the amount due on mortgages.

- (2) Mortgages subsequently issued.

*Balance—*

Represents the total amount owing on mortgages payable.

### 8—RESERVES

(8-1)—*Reserve for Depreciation on Machinery and Equipment*

(8-2)—*Reserve for Depreciation on Buildings:*

*Debits—*

- (1) With that portion of the cost which has been depreciated of anything replaced or sold.

*Credits—*

- (1) Open the account with the amount of reserve allowed for depreciation;  
(2) Depreciation charge to departmental or general expenses equivalent to a pro rata amount of the annual depreciation charge.

*Balance—*

Represents the allowance for depreciation of permanent plant investments and maintained as offsetting accounts to the respective fixed asset accounts.

*Note:*—If the present net book value (first cost less depreciation amount) cannot be determined for any particular article replaced, the first cost should be credited to the fixed asset account and charged to the corresponding reserve for depreciation. If, however, the article replaced is sold or otherwise disposed of at a scrap value, the first cost should be credited to the fixed asset account and first cost less scrap or exchange value should be charged to the corresponding reserve for depreciation. The scrap value should, of course, be charged to the purchaser.

(8-3)—*Reserve for Bad Debts:*

*Debits—*

- (1) With value of accounts receivable considered uncollectible, crediting the individual customers' accounts so written off.

*Credits—*

- (1) Open the account with an amount considered sufficient to cover all losses on accounts considered uncollectible;  
(2) Amount based on a percentage of sales billed to provide for losses on amounts charged during the period.

*Balance—*

Represents allowance reserved for losses on accounts receivable.

### 9—CAPITAL LIABILITIES

(9-1)—*Capital Stock—Preferred Issued*

**(9-2)—Capital Stock—Common Issued:****Debits—**

- (1) With par value of stock returned to or acquired by company.

**Credits—**

- (1) With the par value of stock outstanding.

**Balance—**

Represents the par value of issued capital stock outstanding, preferred and common, respectively.

**10—SURPLUS AND PROFIT AND LOSS ACCOUNTS****(10-1)—Surplus:****Debits—**

- (1) With the amount of dividends at annual closing;  
(2) With amount transferred from profit and loss (if loss) at annual closing period.

**Credits—**

- (1) Open the account with the amount of undivided profits;  
(2) With profits made during the current year transferred from profit and loss at annual closing.

**Balance—**

Represents undivided profits, if a credit;

Represents deficit, if a debit.

*Note:*—Make no entries to surplus account except at annual closing time.

**(10-2)—Income and Excess Profits Tax Account:****Debits—**

With amount of income and excess profits tax paid.

**Credits—**

With any necessary adjustments.

**Balance—**

Represents amount of income and excess profits taxes paid.

**(10-3)—Dividends—Preferred Stock:****Debits—**

- (1) With the amount of dividends paid.

**Credits—**

- (1) With debit to surplus at close of year.

**Balance—**

Represents dividends paid.

**(10-4)—Dividends—Common Stock:****Debits—**

- (1) With the amount of dividends paid.

**Credits—**

- (1) With debit to surplus at close of year.



*Balance—*

Represents dividends paid.

*(10-5)—Profit and Loss**At Annual Closing Time:**Debits—*

- (1) With debit balance of cost of castings sales;
- (2) With debit balance of cost of miscellaneous sales;
- (3) With debit balance of freight out on sales;
- (4) With debit balance of administrative expenses;
- (5) With debit balance of selling expenses;
- (6) With debit balance of interest paid;
- (7) With debit balance of discount given;
- (8) With net amount of plant balances (Operating expense accounts Nos. 12-1 to 12-18 inclusive) if such amounts are debit balances;
- (9) With debit balance of adjustment account.

*At Annual Closing Times:**Credits—*

- (1) With credit balances of castings sales billed;
- (2) With credit balance of miscellaneous sales;
- (3) With credit balance of interest received;
- (4) With credit balance of discount taken;
- (5) With credit balance of interest on investments;
- (6) With net amount of plant balances (Operating expense accounts 12-1 to 12-18 inclusive) if such amounts are credit balances;
- (7) With credit balance of adjustment account.

*Balance—*

Represents net profit or loss resulting from transactions of the period accumulated.

*(10-6)—Adjustment Account:**Debits—*

- (1) With any determinable decrease in any particular account not traceable to some other account;
- (2) With necessary adjustments of any nature.

*Credits—*

- (1) At closing periods with any determinable increase in any particular account not traceable to some other account;
- (2) With necessary adjustments of any nature.

*Balance—*

Represents adjustments necessarily made.

*(10-7)—Castings Sales:**Debits—*

- (1) With the billed amount of castings returned by customers;

- (2) With allowances to customers as represented by credit memoranda if a sale reduction;
- (3) With credit balance, transferring to profit and loss at annual closing time.

*Credits—*

- (1) Total castings sales billed during the month as represented by the sales register, charging accounts receivable.

*Balance—*

Represents net sales billed.

(10-8)—*Cost of Casting Sales:*

*Debits—*

- (1) Cost value of all material shipped as represented by the summary of daily reports of shipments.

*Credits—*

- (1) Cost of material returned by customers during the period;
- (2) With the debit balance at the end of closing periods charging profit and loss.

*Balance—*

Represents net factory cost of shipments.

(10-9)—*Miscellaneous Sales:*

*Debits—*

- (1) With value at sale price of any returned sales.

*Credits—*

- (1) With sale value of any nature other than castings sales.

*Balance—*

Value of miscellaneous sales.

(10-10)—*Cost of Miscellaneous Sales:*

*Debits—*

- (1) With cost of above sales.

*Credits—*

- (1) With cost of any returned sales.

*Balance—*

Net cost of miscellaneous sales.

(10-11)—*Freight Out On Sales:*

*Debits—*

- (1) With all payments of transportation of any nature for delivery of goods to customers.

*Credits—*

- (1) With necessary adjustments.

*Balance—*

Net cost of delivering sales to customers.

(10-12)—*Administrative Expenses:*

*Debits—*

- (1) With all charges for administrative expenses.

*Credits—*

- (1) With debit balance at closing periods charging profit and loss.

*Balance—*

Represented aggregate of administrative expenses.

(10-13)—*Selling Expenses:*

*Debits—*

- (1) With the aggregate of charges to all expense accounts classified as selling expenses.

*Credits—*

- (1) With debit balance at closing periods charging profit and loss.

*Balance—*

Represented aggregate of selling expenses.

## 11—FINANCIAL PROFIT AND LOSS ACCOUNTS

(11-1)—*Interest Received:*

*Debits—*

- (1) With necessary adjustments.

*Credits—*

- (1) With all interest received for balances or overdue accounts.

*Balance—*

Net interest received.

(11-2)—*Discount Taken:*

*Debits—*

- (1) With credit balance, transferring to profit and loss.

*Credits—*

- (1) With all cash discounts earned; does not include trade discounts.

*Balance—*

Represents cash discounts earned.

(11-3)—*Interest Paid:*

*Debits—*

- (1) At closing periods with the amount of interest accrued for the month on items payable, crediting accrued interest or prepaid interest.

*Credits—*

- (1) With debit balance, transferring to profit and loss.

*Balance—*

Represents amount of interest actually incurred.

*Note:*—If interest is prepaid, the payment should be charged to prepaid interest (Acct. 4-3). The amount should be liquidated in monthly amounts to apportion the charge equitably over the periods involved. (See Account 6-6.)

(11-4)—*Discount Given:*

*Debits—*

- (1) Cash discounts allowed customers—does not include trade discounts.

*Credits—*

- (1) With debit balance, transferring to profit and loss.

*Balance—*

Represents cash discounts allowed.

(11-5)—*Interest or Dividends on Investments:*

*Debits—*

- (1) With necessary adjustments.

*Credits—*

- (1) With interest or dividends received on investments. This should be treated as separate from regular commercial interest.

*Balance—*

Net results of regular income from outside investments.

## 12—OPERATING EXPENSES

*Explanatory Note:*

Accounts 12-1 to 12-18 inclusive cover the actual operating accounts; i.e., those that appear in the actual cost sheet, either by pound, percentage, or hour.

If reference is made to the skeleton statements, it will be noted that "Total to Date" is used, both in the body of the statement and in the comparative monthly statement. It is quite evident, therefore, that if there were but one account for each burden and cost statement, which was credited with the transfer at predetermined rates to work in process, there would be no easy way of securing the "To date" figures.

In order to make this easy, two ledger accounts are maintained for each expense or burden account. One, bearing simply the name of the account, is for *debits only*, except where a credit is necessary to *adjust or correct the debits*. The other, bearing the account name followed by "Credits," is for *credits only* of the transfers to work in process, except when a debit may be necessary to *adjust or correct the credits*.

The result is an accumulating figure for each kind of account. This provides, from the general ledger trial balance, the figures to use in the statements of "Total to Date"—the monthly figures coming from the footings for the month's transactions, which *must* balance with the entries for the month in the ledger account controlling each expense account.

It is quickly seen, therefore, that the difference between the "debit" and "credit" account for each expense account is the over- or under-absorbed expense, and will and *must* agree with the monthly statements.

Accounts 12-19 to 12-22 inclusive need but a single account as they are to be *entirely closed out* each month. They are simply collective accounts serving as mediums to split down these expenses to the actual operating accounts.

\* \* \* \* \*

(12-1)—*Cost of Melt:*

*Debits—*

- (1) Melting stock metals used (requisitions);
- (2) Labor (time cards);
- (3) Miscellaneous materials (requisitions);
- (4) Charges direct from purchase register (expense ledger charge slips);
- (5) Apportioned charges.

*Credits—*

- (1) Adjustments of debits only.

(12-2)—*Cost of Melt—Credits:*

*Debits—*

- (1) Adjustments of credits only.

*Credits—*

- (1) Value of metal poured at the standard predetermined rate.

(12-3)—*Molding Burden—Direct Labor:*

*Debits—*

- (1) Labor (time cards);
- (2) Materials (requisitions);
- (3) Charges direct from purchase journal (expense ledger charge slips);
- (4) Apportioned charges.

*Credits—*

- (1) Adjustments of debits only.

(12-4)—*Molding Burden—Direct Labor—Credits:*

*Debits—*

- (1) Adjustment of credits only.

*Credits—*

- (1) Amount equal to molding direct labor times the standard rate.

(12-5)—*Molding Burden—Machine Hour:*

*Debits—*

- (1) Labor (time cards);
- (2) Materials (requisitions);
- (3) Charges direct from purchase journal (expense ledger charge slips);

(4) Apportioned charges.

*Credits—*

(1) Adjustment of debits only.

(12-6)—*Molding Burden—Machine Hour—Credits:*

*Debits—*

(1) Adjustments of credits only.

*Credits—*

(1) Amount equal to actual machine hours used times the standard rate per hour.

(12-7)—*Molding Sand Cost (If used):*

*Debits—*

(1) Labor (time tickets);

(2) Materials (requisitions);

(3) Charges direct from purchase journal (expense ledger charge slips).

*Credits—*

(1) Adjustments of debits only.

(12-8)—*Molding Sand Cost—Credits (If used):*

*Debits—*

(1) Adjustments of credits only.

*Credits—*

(1) Amount equal to total metal poured times the standard rate per pound.

(12-9)—*Flask Cost (If used):*

*Debits—*

(1) Labor (time tickets);

(2) Materials (requisitions);

(3) Charges direct from purchase journal (expense ledger charge slips);

(4) With total monthly charges in pattern-shop expense accounts Nos. 704 and 705 (by transfer).

*Credits—*

(1) Adjustments of debits only.

(12-10)—*Flask Cost—Credits (If used):*

*Debits—*

(1) Adjustments of credits only.

*Credits—*

(1) Amount equal to total good castings times the standard rate per pound.

(12-11)—*Coremaking Burden—Direct Labor:*

*Debits—*

(1) Labor (time tickets);

(2) Material (requisitions);

- (3) Charges direct from purchase journal (expense ledger charge slips);
- (4) Apportioned charges.
- Credits—*
  - (1) Adjustments of debits only.
- (12-12)—*Coremaking Burden—Direct Labor—Credits:*
  - Debits—*
    - (1) Adjustments of credits only.
  - Credits—*
    - (1) Amount equal to coremaking direct labor times the standard rate.
- (12-13)—*Coremaking Burden—Machine Hour:*
  - Debits—*
    - (1) Labor (time tickets);
    - (2) Material (requisitions);
    - (3) Charges direct from purchase journal (expense ledger charge slips);
    - (4) Apportioned charges.
  - Credits—*
    - (1) Adjustments of debits only.
- (12-14)—*Coremaking Burden—Machine Hour—Credits:*
  - Debits—*
    - (1) Adjustments of credits only.
  - Credits—*
    - (1) Amount equal to actual machine hours used times the standard rate per hour.
- (12-15)—*Finishing Cost:*
  - Debits—*
    - (1) Labor (direct and indirect unless in large plants) (time tickets);
    - (2) Material (requisitions);
    - (3) Charges from purchase journal (expense ledger charge slips);
    - (4) Apportioned charges.
  - Credits—*
    - (1) Adjustments of debits only.
- (12-16)—*Finishing Cost—Credits:*
  - Debits—*
    - (1) Adjustments of credits only.
  - Credits—*
    - (1) Amount equal to molding and core direct labor times the standard rate.
- (12-17)—*Annealing Cost:*
  - Debits—*
    - (1) Labor (time tickets);

- (2) Material (requisitions);
- (3) Charges direct from purchase journal (expense ledger charge slips);
- (4) Apportioned charges.

*Credits—*

- (1) Adjustments of debits only.

(12-18)—*Annealing Cost—Credits:*

*Debits—*

- (1) Adjustments of credits only.

*Credits—*

- (1) Amount equal to total good castings times the standard rate.

(12-19)—*Power, Light and Heat Expense:*

*Debits—*

- (1) Labor (time cards);
- (2) Material (requisitions);
- (3) Charges direct from purchase journal (expense ledger charge slips);
- (4) Apportioned charges.

*Credits—*

- (1) With total net balance at the close of each month distributed to the various operating accounts as explained elsewhere.

*Balance—*

There should be no balance.

(12-20)—*Pattern-Shop Expense:*

*Debits—*

- (1) Labor (time tickets);
- (2) Materials (requisitions);
- (3) Charges direct from purchase journal (expense ledger charge slips);
- (4) Apportioned charges.

*Credits—*

- (1) With amount which charges the molding burden—direct labor;
- (2) With amount which charges the coremaking burden—direct labor;
- (3) With amounts which charge the flask cost;
- (4) With amount of residue as directed.

*Balance—*

There should be no balance.

*Note:*—If the pattern-shop is operated as a producing department, and not solely as a co-operating department, the accounting should be changed to correspond to the condition, and provision should be made for:

- 1—Pattern production orders;



- 2—Pattern productive labor;
- 3—Pattern-shop expense account;
- 4—Pattern work in process material. The cost compilation must be changed accordingly.

(12-21)—*General Expense:*

*Debits—*

- (1) Labor (time tickets);
- (2) Material (requisitions);
- (3) Charges direct from purchase journal (expense ledger debit slips);
- (4) Apportioned charges.

*Credits—*

- (1) With total net balance at end of each month distributed on the prescribed basis to each operating account.

*Balance—*

There should be no balance.

(12-22)—*Expense Ledger Account:*

*Debits—*

- (1) At end of each month, with the total of charges made direct to operating accounts, which charges are represented by expense ledger charge slips.

*Credits—*

- (1) With the total of expense ledger charge slips charging the various operating accounts.

*Balance—*

If any balance exists, it is in error, and the charge slips in the files for month should be checked back to the purchase journal.

### 13—SUNDRY GENERAL LEDGER ACCOUNTS

In this section of the ledger are located all sundry accounts with firms and individuals, irrespective of whether their balance is debit or credit. There are always a number of accounts of so general a nature that they only properly belong in this section.

When making up a statement, the accounts classify themselves according to their balances into two classes:

General ledger accounts receivable;

General ledger accounts payable.

They will be so entered in the statements immediately under the accounts receivable, and accounts payable respectively.

### Journal Entries

The following sequence of journalizing should be followed in order to distribute the various details into the cost of pro-

duction and reflect the condition properly on the general ledger :

1. Pay-roll.
2. Materials and supplies.
3. Liability insurance.
4. Depreciation.
5. Taxes.
6. Fire insurance.
7. Power, heat, and light.
8. Pattern-shop expenses.
9. General expenses.
10. Departmental expenses.
11. Reversing foundry scrap.
12. Finished castings.
13. Shipments.

The following pages illustrate the details of the journal entries required :

1. PAY-ROLL:

*Debit—*

Work in process (direct labor).  
Cost of melt (conversion labor).  
Molding burden—direct labor.  
Molding burden—machine hour.  
Molding sand cost.  
Flask cost.  
Coremaking burden—direct labor.  
Coremaking burden—machine hour.  
Finishing cost.  
Annealing cost.  
Pattern-shop expenses.  
Power, heat, and light expenses.  
General expenses.

*Credit—*

Accrued pay-roll.

*Purpose—*

To distribute labor charges for the current month to the accounts receiving benefits.

*Source—*

Direct labor charges are taken from the molding and coremaking pay-roll sheets and should equal the total of all direct labor daily time tickets filed under production order numbers or class numbers for the same period.

Indirect labor charges to cost and burden accounts are obtained from the compilation of indirect-labor daily time tickets, filed under the various expense account numbers. . . . The values thus accumulated by summarizing the labor tickets must agree with the total of the pay-roll for the same period.

**2. MATERIALS AND SUPPLIES:***Debit—*

Cost of melt (Melting and conversion materials).

Molding burden—direct labor.

Molding burden—machine hour.

Molding sand cost.

Flask cost.

Coremaking burden—direct labor.

Coremaking burden—machine hour.

Finishing Cost.

Annealing Cost.

Pattern-shop expenses.

Power, heat, and light expenses.

General expenses.

*Credit—*

Melting Stock—metals:

1. Pig iron.

2. Purchased scrap.

3. Foundry scrap.

4. Ferromanganese.

5. Ferrosilicon.

General stores.

Any other controlling material accounts.

Expense ledger.

*Purpose—*

To distribute material requisitions and expense ledger charges for the current month.

*Source—*

These charges are derived from a monthly summary of cupola or furnace reports, material requisitions, and expense ledger charge slips, representing materials consumed or purchases made during the current month distributed to the cost and burden accounts.

### 3. LIABILITY INSURANCE:

*Debit—*

Cost of melt.  
Molding burden—direct labor.  
Molding burden—machine hour.  
Coremaking burden—direct labor.  
Coremaking burden—machine hour.  
Finishing Cost.  
Annealing Cost.  
Pattern-shop expenses.  
Power, heat, and light expenses.  
General expenses.

*Credit—*

Unexpired insurance.

*Purpose—*

To distribute pro rata amount of liability insurance premiums to the current month.

*Source—*

This distribution is based on an estimated monthly amount sufficient to absorb the yearly total of liability insurance premiums. The prorating is based on the actual rate of the wages paid in each of the above accounts.

### 4. DEPRECIATION:

*Debit—*

Cost of melt.  
Molding burden—direct labor.  
Molding burden—machine hour.  
Coremaking burden—direct labor.  
Coremaking burden—machine hour.  
Finishing Cost.  
Annealing Cost.  
Pattern-shop expenses.  
Power, heat, and light expenses.  
General expenses.

*Credit—*

Reserve for plant depreciation (As many Reserve Accounts as desired)

*Purpose—*

To distribute the pro rata amount of annual depreciation charge to the current month.

*Source—*

One-twelfth of the annual depreciation charge distributed to the various departments, based on the investment in each department.

**5. TAXES:***Debit—*

Cost of melt.  
Molding burden.  
Coremaking burden.  
Finishing Cost.  
Annealing Cost.  
Pattern-shop expenses.  
Power, heat, and light expenses.  
General expenses.  
(In small plants this may all go to General Expense.)

*Credit—*

Accrued taxes.

*Purpose—*

To distribute the pro rata amount of estimated accrued taxes to the current month.

*Source—*

One-twelfth of the estimated amount of yearly taxes distributed to the various departments based on the taxable property in each department.

**6. FIRE INSURANCE:***Debit—*

General expense.

*Credit—*

Unexpired insurance.

*Purpose—*

To distribute the pro rata amount of fire insurance premiums to the current month.

*Source—*

One-twelfth of the annual amount of fire insurance premiums.

**7. POWER, HEAT, AND LIGHT:***Debit—*

Cost of melt.  
Molding burden—direct labor.  
Molding burden—machine hour.  
Coremaking burden—direct labor.  
Coremaking burden—machine hour.  
Finishing Cost.  
Annealing Cost.  
Pattern-shop expenses.  
General expenses.

*Credit—*

Power, heat, and light expenses.

*Purpose—*

To distribute power, heat and light expense of the current month.

*Source—*

The total of expenses summarized under power, heat, and light expenses. . . .

## 8. PATTERN-SHOP EXPENSES:

*Debit—*

Molding burden.

Coremaking burden.

*Credit—*

Pattern-shop expenses.

*Purpose—*

To distribute pattern-shop expenses of the current month.

*Source—*

The total of expenses summarized under pattern-shop expenses. . . .

## 9. GENERAL EXPENSES:

*Debit—*

Cost of melt.

Molding burden.

Coremaking burden.

Finishing Cost.

Annealing Cost.

*Credit—*

General expenses.

*Purpose—*

To distribute the general expenses of the current month.

*Source—*

The total of expenses summarized under general expenses. . . .

The basis of distribution is the total monthly labor cost in each of the above departments.

## 10. DEPARTMENTAL EXPENSES:

*Debit—*

Work in process.

*Credit—*

Cost of melt (credit account).

Molding burden—direct labor (credit account).

Molding burden—machine hour (credit account).

Molding and sand cost (credit account).

Flask cost (credit account).

Coremaking burden—direct labor (credit account).  
Coremaking burden—machine hour (credit account).  
Finishing cost (credit account).  
Annealing cost (credit account).

*Purpose—*

To transfer departmental burden and costs at their standard rate for the current month to work in process.

Note:—Each account will have a net debit or credit balance which should be shown each month on the profit and loss statement. Actual closing of these departmental burden and cost accounts will not be made until the end of the year, when they will be closed into profit and loss. Throughout the year the debit and credit postings to these departmental burden and cost accounts will be accumulative totals for trial balance and checking purposes.

11. FOUNDRY SCRAP:

*Debit—*

Foundry scrap—

*Credit—*

Work in Process.

*Purpose—*

To reverse the scrap value of bad castings and sprues accumulated during the current month.

*Source—*

The total scrap value of bad castings and sprues as represented by monthly summary of inspectors' rejection reports, showing weights of bad castings and sprues by classes or order numbers.

12. FINISHED CASTINGS:

*Debit—*

Finished castings (if account is used).

*Credit—*

Work in process.

*Purpose—*

To transfer from work in process to finished castings account value of finished product delivered to finished castings stores.

*Source—*

Summary of delivery tickets or scale reports representing the delivery of finished castings to stock.

13. SHIPMENTS:

*Debit—*

Cost of castings sales.

*Credit—*

Work in process, or

Finished castings (if that account is used).

*Purpose—*

To cover the cost of castings shipped during current month.

*Source—*

Summary cost value applied on memoranda of shipments made during the current month.



## CHAPTER XXI

### EXPENSE AND BURDEN STATEMENTS

#### General Nature of Expense and Burden Statements

After all the items chargeable to each expense and burden account are properly taken care of under each of these accounts, the next step is to assemble all the figures under their proper order numbers, or their designation, in order to arrive at the total cost of each account, and thereby reach the point of assembling the expense and burden statements.

In order to derive real benefits from such figures, the matter of compiling the figures in usable shape becomes one of the greatest importance. Many industrial institutions, though they assemble thousands of figures, neglect to do more than file the figures in obscure places, making no real managerial use of them. The greatest attention should be paid, therefore, to the collating of such figures into neat, attractive, and comprehensive statements which not only are correct and properly reflect the conditions as they exist, but are so presented that it is a pleasure for anyone to study them. By so doing one becomes very deeply interested in accomplishing reforms based on the figures shown.

The great importance of establishing the basis of costs, and also the great need for and benefits to be accrued from the proper departmentalization of the plant, have been taken up in detail in other chapters.

The present chapter deals with the matter of expense and burden statements, a matter which if not properly handled will entirely nullify all efforts to produce useful results from assembling indirect costs. In other words, the culmination of all that has been outlined is reached in the effectiveness with

which the elusive indirect costs can be set down in the expense and burden statements.

### **Distinction between Expense and Burden Accounts**

As has been explained elsewhere, indirect costs are treated in two main classes :

1. Expenses, which are, after collection, distributed to other expense accounts or to burden accounts.
2. Burdens, which are the final collection of all indirect costs of each operating department, and which appear in the actual cost sheets of goods produced.

Expenses which are finally distributed both to other expense accounts and to burden accounts as well are exemplified by Steam Expense, Electric Power Expense, Compressed Air Expense, and Trucking Expense.

Examples of expenses which may receive charges from other expense accounts before being distributed to the burden accounts are: General Superintendent's Office Expense, Cost Department Expense, Pay-Roll Department Expense, General Stores Expense.

Burden accounts are those departmental accounts which are necessary to show accurately the indirect cost of each department in order to effect a true application of these costs to the product.

### **The Great Value of Detail**

It is in the presentation of the various expense and burden accounts that the great value of detail is realized. By this is meant good, wholesome, analytical detail which is designed to answer automatically all questions before they are asked.

A short time ago a case was noted in which five expense order numbers were used. In one department, four of these numbers which specified certain operations showed a total

altogether of about \$1,200, whereas the fifth order number, entitled "Miscellaneous," had over \$12,000 against it. A statement of this sort is valueless.

Within reason, the standing order code should be sufficiently detailed as to analysis of cost to make the statements tell a complete story. If fifty orders are necessary to do this—have fifty. A statement of lump sums is a wasted statement and had better not be compiled.

### **Fallacy of High Cost of Detail**

Many managers, and lesser lights as well, rebel at a well-analyzed standing order code, saying that the work is so great and the cost of keeping the records is so high that it is impracticable. This is a most unfortunate mistake. It must be that such judgment is expressed in ignorance of true circumstances, and through an entire lack of real study of the subject. A little reasoning will clear up this point.

A standing order code is prepared, and a comprehensive and well-detailed dissection of all expenses and burdens is made. This is quite a task, but it needs to be done only once. The code is then printed in book form and becomes permanent. Putting the code number for the work performed on the time card covering the work involves simply the very slight time necessary to refer to the code book, to make sure of the right order number. This in itself is soon a matter of memory. When filing the cards in cost files it is practically as easy to file fifty numbers as ten.

Footing the time cards for entry on statements takes a little more work—but only that of clearing the adding machine fifty times instead of ten and putting down the totals. This comes, moreover, but once a month. The truth is, the fear of having too much detail is entirely without ground, and a careful investigation would soon prove that a detailed analysis of indirect cost is a valuable asset.

### Proving of All Statements

Before going on with the technique of making up statements, it is important to emphasize strongly the absolute necessity of proving all steps performed. This can be done with the aid of controlling accounts.

It will be remembered that a controlling account must be set up in the ledger for each expense and burden account. Debits to these accounts are distributed through the journal from the following originating sources:

1. Labor, from a recapitulation of time cards.
2. Material, from a recapitulation of requisitions.
3. Expense, direct from voucher register, a recapitulation of expense debit slips.
4. Miscellaneous apportioned charges from standard monthly entries and other expense distribution.

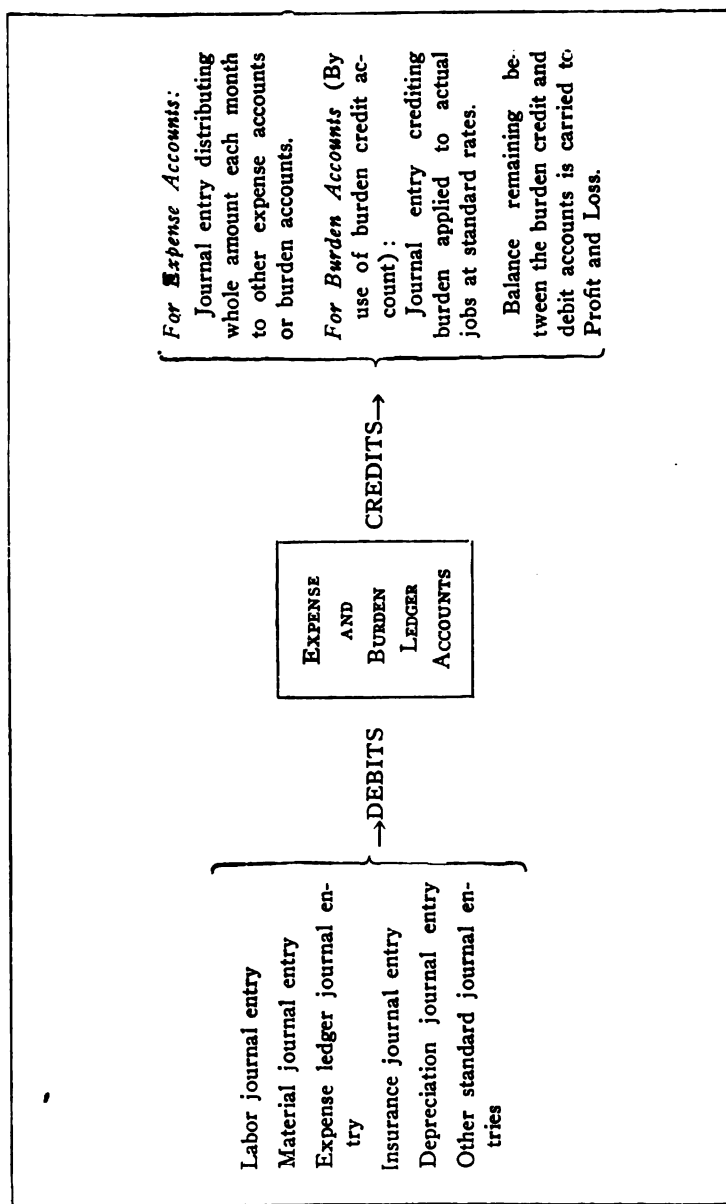
As all plant expense accounts are credited out in full each month, the control account of each plant expense is used merely as a collecting and proving account so far as the ledger is concerned, and does not appear on the trial balance.

A semigraphic illustration of the flow of entries into and out of the expense and burden ledger accounts is shown in Form 32.

The burden control accounts are never credited during the year except for correction, the credits for burden applied in costs being credited to a parallel "Burden Credit" account. (See Chapter XVII.) This is done in order to allow the burden accounts—both debit and credit—to accumulate, thereby giving a control for statement purposes which otherwise would be impossible.

### Structure of Statements

In general, all expense and burden statements include three main features:



Form 32. Chart Showing Flow of Costs in and out of Expense and Burden Accounts



statements are as follows: (1) the form of statement as it is to be presented (shown on pages 295 and 296); (2) the working sheets for assembling the figures to be entered on the regular statements (shown in Form 33).

These sheets should be prepared, so far as possible, before the end of the month in order to speed up the work when the month closes. This will include headings, account numbers (and names on the regular statements), and

1. On the regular statements, the figures for the previous month.
2. On the working sheets, the *total* to and including the previous month.

### Preparing Data

After all time cards, requisitions, and expense debit slips are properly filed, the first step in preparing the statements is to sort all data under each order number.

1. Time cards should be sorted into:

- (a) Cards which account for "own labor," i.e., work done by men belonging to the department being accounted for, and where no burden of another department is involved.
- (b) Cards which account for work done by other departments and where the burden of the other department is charged.

2. Requisitions and expense debit slips should be sorted so that they may be added separately.

### Footings and Entering Data

With all details ready, the next step is the accumulation and entry of the various order number totals on the skeleton or collating sheets. The procedure is the same whether the work is done by manual labor or on electric adding machines.

1. The time cards of "Own Labor," representing the work done by any department on its own standing orders, is footed for each order and entered under this heading on the skeleton sheet.

2. The time cards stamped "O.D.S.O.," representing work done for one department by other departments, and which are extended not only with the labor cost of the work performed but also with the amount of burden thereon, will be footed to show the total for each order of both the labor and burden cost. (See Chapter XVI.) These totals will be entered in the column headed "O.D.S.O. Charges."

3. The totals of all requisitions for each order are accumulated and entered on the skeleton sheet under "Requisitions."

4. The totals of all expense debit slips for each order are accumulated and entered under "Expense Debit Slips."

The foregoing complete all entries which come through the mediums mentioned.

### Entry of Journal Entry Data

All apportioned expenses come through the medium of journal entries. While the main posting of the journal entries is, of course, to the control accounts in the ledger, a short-cut is here possible by also posting the same entries direct to the skeleton sheets. This saves a special journal debit form which otherwise would be necessary.

In making the entries of the journal entry data in connection with the apportioned expenses, the only columns on the collating sheet to be used will be the last three columns, namely, total, total for last month, and total to date.

The names of the various expenses will be written on the sheet starting with the order number column and writing over the next column. This may appear rather unbusinesslike, but as the greatest use of the form is for the information as called for by the headings, and as the various statements for the ex-



pense accounts vary so much in size, it is about the only economical way to use the form.

### **Completion of Skeleton Working Sheets**

When all data have been entered, all entries opposite each order number are cross-footed and the totals entered under the heading "Total." This gives the total cost of each standing order for the month. The next step is to add the total for the month for each order to the "Total for the Last Month," thereby arriving at the "Total to Date" for each order. When cross-footing is complete, the vertical footings are entered on the collating sheet.

The various section totals are cross-footed, and as they must agree with the total of the cross-footed items, it will be noted that the sheet is self-checking so far as the work upon it is concerned.

The expense accounts closed out monthly will of course have no total to date.

### **Proving the Working Sheets with Controls**

It is noted that both the total cost for the month and the total cost to date for each account have been found.

The total cost to date must agree with the balance of the ledger control account for each burden account, and each monthly expense account will of course agree with the ledger control for the month.

If all work has been done correctly, each expense and burden account will come out exactly right. But unfortunately errors happen, and it is the use to which the controls may be put in finding these errors that justifies the apparently extra work of establishing controls.

The checking out by sections is as follows:

1. The total "Own Labor" for each account must equal this total found in the summary of the pay-rolls.

2. The total of the O.D.S.O. charges must equal the total of the debits to the control account, according to the journal entry of same described in Chapter XIX.
3. The total of requisitions for each account must equal the total debit for the same account on the accumulation sheets for the requisition journal entry.
4. The total of expense debits for each account must in like manner equal the corresponding total debit on the accumulation sheets for the expense debit slips journal entry.
5. The postings under "Apportioned Expenses" may be checked directly against the journal.

If the foregoing rules are kept in mind, the errors can usually be located and a little detailed checking will straighten it out.

### Completing the Statements

With the skeleton sheet proved up and correct, the making up of the actual statements is an easy task.

The first move is to copy the current month and total to date into the proper columns on the statement. After this has been done, two things remain:

1. On expense statements, to work out the distribution.
2. On burden statements, to ascertain the total basic units applied to production orders, which are either:
  - (a) Direct-labor hours
  - (b) Direct-labor cost
  - (c) Machine hours

As these two points have been dealt with elsewhere, it is necessary to state here only that after the data have been secured and the journal entries prepared, the distribution of the expense accounts and the burden credits are entered on the statements as illustrated.

### **Sequence of Compilation of Expense and Burden Statements**

Naturally, as explained in other sections, not all expense and burden accounts can be closed at once. Expense accounts, such as Steam, Electric Power, Trucking, etc., must close out first, their distributing journal entries being made, and posting made to other expense controls before they are closed.

Then the second set of expense accounts are closed out, and so on until the entire indirect cost is concentrated in the final set of accounts known as burden accounts, or in a few accounts such as the Melting Cost account in foundries, where the cost is on a pound basis. This final set of accounts is that whose cost, represented by a standard, appears in the actual cost sheets of the goods produced.

### **Comparison of Indirect Costs—I. Expense Accounts**

There remains to be discussed the comparisons of the indirect costs which are designed to give a direct and true line on the results of the work.

It has been brought out before that in every possible case each expense account should be so designed as to give some line—for comparative purposes—on the efficiency of each segregated group. If no check of this sort is maintained, the great advantage of keeping the indirect costs is lost, as a volume of figures without any resulting unit comparison is of no use from a managerial standpoint. The nature of the expense accounts depends largely on the plant which is installing the cost methods, but careful thought will bring about a grouping of expense accounts which will accomplish the desired end.

Nearly every plant, for instance, has a Trucking or Teaming Expense account, and from the nature of the business it can be decided whether or not a section unit can be kept in one of two ways: hours of actual trucking, or tonnage trucked. Then, if the cost of trucking is kept, there can be a very usable and valuable unit cost ascertained on one or the other unit.

A great many plants generate at least a portion of their own power. Even where the power is purchased, more or less equipment is always required to transform and distribute it. Thus a knowledge of unit cost is desirable. The cost per kilowatt hour can be accurately determined, if a meter is installed to show the total number of kilowatt hours generated or purchased and transformed.

If a plant wishes to go to the expense, almost the same procedure can be followed in the case of steam by the use of flow meters. Unit costs can thereby be arrived at which will give a decided check on the production of steam.

The majority of expense accounts belonging to the second set—those which are to be distributed entirely to the burden accounts—are preferably compared on the basis of the total hours spent under the jurisdiction of the department for which the account stands. The second choice of a basis of comparison is the total pay-roll in dollars. This may be illustrated in the case of a Pay-roll Department Expense account where the cost of operating the department is almost in direct ratio to the number of hours of work or value of the hours which the clerical department has to account for. This would apply equally to the cost department, the general superintendent's office, etc.

By all means, care should be taken to avoid an error which is largely prevalent today, namely, of regarding the cost of such departments as being distributable and comparable on the basis of the direct-labor hours or cost of the operating departments. This is entirely wrong, the reason being that a pay-roll department or a cost department or the general superintendent's office is just as deeply involved with the handling of indirect labor as it is with direct labor. Therefore, the cost of these departments should be distributed to the operating departments preferably on the basis of the *total* labor hours both direct and indirect.

## **2. Departmental Burdens**

The basis for comparison to be used for the operating burdens will depend entirely on the method chosen as being the best or most available for cost purposes. By this is meant that the burdens will be applied and used in the costs on the basis of either direct-labor hours, direct-labor cost, or machine hours. Regardless of what method is chosen, there should be for each expense and burden account some comparative table (on the basis of what has been previously explained) in order that a true measure may be obtained of the efficiency of each division of the indirect cost. These comparisons will be set up along the lines of the table on page 297. This table shows a comparison for some months back of the burden accounts and also of the Trucking Expense account illustrated on page 297.

It will be noted that this table shows :

1. The expense for each month and the total to date.
2. The number of basic units for each month with the total to date.
3. The cost per unit for the month and the average per unit to date.

Through the medium of these comparative tables, constant watch can be kept as to whether or not a standard is being adhered to. If the standard is not adhered to, and the tables do not show the reason for the divergence, a study can be made of the full records to ascertain whether or not the difference is of a nature to warrant the changing of a standard. This applies particularly to the burden accounts.

In the case of the expense accounts, the comparative tables will give a true line as to whether or not the ratio of each indirect division, such as the cost department, production department, general superintendent's office, etc., is being maintained as it should be.

## EXPENSE AND BURDEN STATEMENTS

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**HOLDEN MANUFACTURING COMPANY**  
**MACHINE BURDEN ACCOUNT, JUNE, 1920**

(AA)

	Jan. 1 to June 30, 1920	Month of June, 1920	Month of May, 1920
<b>Burden Labor:</b>			
MS-1 Foremen and Assistants.....	\$ 1,887.80	\$ 307.37	\$ 336.22
2 Storekeepers and Timekeepers.....	1,522.10	240.90	252.69
3 General Labor.....	11.05	1.10	2.05
4 Cleaning and Sweeping.....	719.84	103.91	104.61
5 Oiling Shafting.....	98.40	14.27	14.85
6 Work on Account Shop Error.....			
7 Shipping Expense.....	149.98	25.79	21.43
8 Inventory Expense.....	192.92		
	<u>\$ 4,582.09</u>	<u>\$ 693.34</u>	<u>\$ 731.85</u>
<b>Maintenance:</b>			
MS-31 Machinery.....	\$ 1,303.38	\$ 244.71	\$ 166.73
32 Tools.....	1,941.07	278.78	168.88
33 Dies, Jigs, and Templates.....	117.42	3.39	9.73
34 Electrical Apparatus.....	143.67	33.55	3.23
35 Belting.....	190.44	25.48	19.71
36 Fixtures.....	108.85	.49	22.20
37 Other Equipment.....	98.40	.17	13.42
	<u>\$ 3,903.23</u>	<u>\$ 586.57</u>	<u>\$ 403.90</u>
<b>Sundry Expense Material:</b>			
MS-51 Drills.....	\$ 145.96	\$ 14.35	\$ 61.72
52 Small Purch. Tools not otherwise specified.....	146.99	47.61	12.49
53 Lights.....	112.52		26.38
54 Oils and Waste.....	129.01	21.35	21.94
55 Miscellaneous.....	421.18	66.18	54.71
	<u>\$ 955.66</u>	<u>\$ 149.49</u>	<u>\$ 177.24</u>
<b>Total Purely Departmental.....</b>	<b>\$ 9,440.98</b>	<b>\$1,429.40</b>	<b>\$1,312.99</b>
<b>Apportioned Expenses:</b>			
Prop. of Expense Acct. "A".....(UU)	\$ 2,256.15	\$ 447.60	\$ 400.13
" " "B".....(TT)	2,143.37	324.57	323.10
" " Gen. Stores Expense.....(VV)	175.37	28.67	28.19
" " Trucking Expense.....(WW)	406.88	56.14	75.01
" " Liability Insurance.....	708.79	106.45	115.22
Power, Light, and Heat.....(QQ)	2,395.39	311.70	297.27
Miscellaneous Expense.....	120.25	12.43	17.54
Depreciation.....	551.64	91.94	91.94
Bonus.....	2,763.48	421.28	521.81
	<u>\$11,521.32</u>	<u>\$1,800.78</u>	<u>\$1,870.21</u>
	<u>\$20,962.30</u>	<u>\$3,230.18</u>	<u>\$3,183.20</u>
<b>Less—Reclaimed Scrap.....</b>	<b>\$ 1,632.35</b>	<b>\$ 54.80</b>	<b>\$ 867.60</b>
	<u>\$19,329.95</u>	<u>\$3,175.38</u>	<u>\$2,315.60</u>
<b>100% on Prod. Labor Carried to Work in Process Burden Acct.....</b>	<b>\$22,608.62</b>	<b>\$3,354.79</b>	<b>\$3,660.55</b>
<b>Balance carried to Mach. Profit and Loss Acct...</b>	<b>\$ 3,278.67</b>	<b>\$ 179.41</b>	<b>\$1,344.95</b>

(WW)

## HOLDEN MANUFACTURING COMPANY

## TRUCKING EXPENSE, JUNE, 1920

	Jan. 1 to June 30, 1920	Month June, 1920	Month of May, 1920
Trucking Expense:			
G-101 Electric Truck Labor....	\$ 2,090.54	\$ 323.36	\$ 365.90
102 Maint. of or Supplies for Electric Trucks.....	3,010.50	123.94	503.34
103 Gasoline Truck Labor....	1,477.24	136.49	285.64
104 Maint. of or Supplies for Gasoline Trucks.....	2,052.27	548.31	468.37
105 Teaming.....	1,497.19	243.66	260.22
106 Miscellaneous.....	62.63	.40	3.07
	<u>\$10,190.37</u>	<u>\$1,376.16</u>	<u>\$1,886.54</u>
Apportioned Charges: *			
Depreciation.....	\$ 513.00	\$ 85.50	\$ 85.50
Electric Power.....(QQ)	333.06	47.64	43.96
Liability Insurance.....	86.01	11.08	15.70
	<u>\$ 932.07</u>	<u>\$ 144.22</u>	<u>\$ 145.16</u>
Total Expense.....	<u>\$11,122.44</u>	<u>\$1,520.38</u>	<u>\$2,031.70</u>

## DISTRIBUTION FOR MONTH

Dept. 1.....(X)	55.24%	\$ 839.86
2.....(HH)	29.81	453.22
3.....(JJ)	2.50	38.01
4.....(KK)	5.60	85.14
5.....(NN)		
6.....(OO)	2.59	39.38
7.....(MM)	3.88	58.99
8.....(PP)	.38	5.78
		<u>\$1,520.38</u>

COMPARATIVE TABLES  
MACHINE-SHOP  
PERCENTAGE OF BURDEN

Month	PRODUCTIVE LABOR		BURDEN		% OF BURDEN	
	For Mo.	Total	For Mo.	Total	For Mo.	Average
Jan., 1920.	\$4,699.47	\$ 4,699.47	\$3,249.91	\$ 3,249.91	69.15%	69.15%
Feb. "	4,214.05	8,913.52	3,279.70	6,529.61	77.83	73.25
Mar. "	3,150.26	12,063.78	3,697.00	10,226.61	117.36	84.77
Apr. "	3,529.50	15,593.28	3,612.36	13,838.97	102.35	88.75
May "	3,660.55	19,253.83	2,315.60	16,154.57	63.26	83.90
June "	3,354.79	22,608.62	3,175.38	19,329.95	94.65	85.50

TRUCKING COSTS PER HOUR

Month	COST		TRUCKING HOURS		COST PER HOUR	
	For Mo.	Total	For Mo.	Total	For Mo.	Average
Jan., 1920.	\$1,198.20	\$1,198.20	1,200	1,200	\$ .998	\$ .998
Feb. "	1,246.30	2,444.50	1,210	2,410	1.03	1.014
Mar. "	1,226.15	3,670.65	1,208	3,618	1.015	1.014
Apr. "	1,204.03	4,874.68	1,212	4,830	.993	1.009
May "	1,190.10	6,064.78	1,230	6,060	.967	1.001
June "	1,194.00	7,258.78	1,236	7,296	.966	.995

**Proper Presentation Indispensable**

The fact should be emphasized again that it is wholly useless to spend the money to collect a mass of figures and fail to display them in presentable and useful form. The ultimate presentation of any figures whatever in connection with an industrial institution is the final and actual test as to the real value of all the endeavor which has been made.

A great many people think that it is unnecessary to spend money for neatly typewritten statements. They are much inclined to use pencil memoranda and rough sheets of figures which should never be dignified by the name of statements. The truth is, too much attention can hardly be paid to the neatness and clearness of the presentation of any figures which may be assembled for managerial or other purposes.



## CHAPTER XXII

### FINANCIAL STATEMENTS

#### Value of Financial Statements

The ultimate object of any manufacturing institution is to make money. The measure of every operation is its value in assisting to attain the ultimate object.

In the past, executives of manufacturing plants paid a preponderance of attention to those details which have largely to do with the actual manufacture of the product. This led many managers to give subordinates too much leeway in the purchase of the machinery and equipment directly used in the producing of goods, and as a result too little consideration was given to the contributing features which have an essential bearing on the effective operation of the equipment.

It was then found out that the actual mechanical operations of production were largely hampered if they were not properly served by the contributing operations of storing and supplying of material to be used in the manufacture. This caused more attention to be paid to all matters of storage and facilities for delivering the various raw materials and supplies to the scene of action. As time has gone on, it has come to be realized that still other matters required additional attention, in fact, that there must be a tightening up of all procedures which have to do with the management of not only materials, but men.

All this has brought about a perfecting of methods of control through the medium of records, the necessity of which is apparent to anyone who desires to manage a business on the basis of actual knowledge, not guesswork. This perfecting of records has not only extended to matters connected with the handling of materials in the plant, the scheduling of produc-

tion, and the like, but has become most important in the accounting of costs—particularly as the recent increases in wages have made it necessary to be absolutely sure as to how far anyone can go with safety and still manufacture goods at a profit. Therefore, the importance of financial statements from a managerial standpoint can readily be seen.

### **Nature of Statements**

Statements for managerial purposes must be complete. This does not mean that they should be voluminous—a manager should not be obliged to wade through a large volume of figures to find out what he wishes to know. But it does mean that the statements which are presented to the manager shall be in such condition that he will be able to find the answer to almost every question without having to ask for special figures.

In other places in this volume, emphasis has been laid on the necessity of monthly statements. The methods set forth have been designed to enable anyone to work up accurate statements of profit and loss, verified by the control accounts in the ledger. The manager needs to have presented to him only a résumé of these statements in order to enable him to perform intelligently his duties as manager. This résumé should be assembled in approximately the following order.

#### **1. Balance Sheet**

The balance sheet will show the assets and liabilities in exactly the same form as they are usually shown once per year. The figures for this statement are obtained from the trial balance of the various control accounts. The balance sheet shows also the profit for the month and for the year to date, which profit verifies the Profit and Loss account.

In connection with each balance sheet there should be shown subsidiary statements or schedules giving information

in regard to various items which appear on the balance sheet, for example :

1. Schedules of general ledger accounts receivable, meaning other than customers' accounts receivable.
2. Schedule of bills receivable, meaning notes receivable.
3. Schedule of raw material inventory balances, there being only one figure put in the statement representing the total.
4. Schedule of work in process account balances. Schedules (3) and (4) may be combined into one statement.
5. Schedule of plant investment accounts.
6. Schedule of prepaid accounts.
7. Schedule of bills payable, meaning notes payable.
8. Schedule of general ledger accounts payable, meaning accounts other than those of creditors.
9. Schedule of reserve accounts.
10. Detail of surplus account.

The above schedules are given merely for illustrative purposes. In small businesses the items themselves may all appear in the balance sheet, but in larger institutions it is better, when making up a balance sheet, to cover the detail with only one item, in order to present a balance sheet in one-sheet form.

It is always desirable to present a balance sheet on a single sheet of paper, if possible, and to have the explanatory schedules in their proper order on other sheets. When this method is followed, it is always best to follow each item on the balance sheet with a reference figure or letter, designating the subsidiary schedule, and to head each schedule with its reference figure.

It is usually best to assemble two kinds of balance sheets, one of them designed for presentation to banks, and a comparative form which is of great value to the manager. The

form for bank use is illustrated on page 311, and the comparative form for managerial use on page 312.

It will be noted in the statement on page 312 that two columns of increase and decrease are shown, one being the increase or decrease over the end of the previous year, and the other over the previous month. These comparisons are decidedly advantageous, as they bring out constantly the increase or decrease in all such vital items as inventories which, from a managerial standpoint, are exceedingly important.

The financial end of the business is most decidedly interested in the fluctuation of inventories, which results often in very stringent action to curb the amount of money tied up in them. That in turn results in pressure to liquidate raw material inventories and to take special measures to decrease the amount of work in process in the plant and turn it into money.

## 2. Profit and Loss Statement

The profit and loss statement is shown in condensed form on page 314. Here again, the device of subsidiary statements is used, in order to reduce the size of the profit and loss statement. In smaller enterprises it is possible to put all detail in the profit and loss statement itself, but it is usually found best to confine the main profit and loss statement to the headings as shown in this illustration, relying on the subsidiary schedules to give greater detail if desired. In connection with the illustration shown, the following schedules may be required for further analysis of items shown in the profit and loss statement:

*Schedule of Sales Results.* Nearly every industrial institution finds it advantageous to have more than one sales account. For instance, an agricultural implement manufacturer may find it of advantage to have a Tractor Sales account, a Tractor Repairs Sales account, a Cultivator Sales account, a Cultivator Repairs Sales account, and so on, with proper analy-

ses of the sales. In connection with each Sales account there are always two other accounts—Freight Out on Sales and Cost of Sales. Therefore, a subsidiary statement of sales would have for each Sales account a statement of the gross sales, and a statement of the freight paid on delivery of such sales deducted from the gross sales, which leaves the net value of each sales division. There would be shown also the cost of sales, which means the figured cost of the article shipped, covering material, labor, and factory overhead at *standard* rates. This would then leave the net result of each particular sales division, permitting the figuring of the percentage of profit in each case.

The net results of all the individual sales accounts would equal, in total, the accumulated figure shown in the profit and loss statement for each item of sales, freight out on sales, sales cost, and gross profit.

*Schedule of Plant Balances.* In any institution where the number of operating departments is quite large, and where it is not an advantage to carry into the plant balance section of the profit and loss statement the balance of over- or under-absorbed burden of each department, it is an advantage to have a subsidiary statement called "Plant Balances" on which these over- or under-absorbed balances are shown after each department has been given credit for the actual burden applied to costs.

The net result as shown by this statement is either a deduction from or an addition to the gross profit shown under the sales headings. That gives in the profit and loss statement, after this deduction or addition has been made, the net manufacturing profit on the goods sold.

*Schedule of Administrative Expense, and Schedule of Selling Expense.* As these two headings require the same comment on account of being largely of the same nature, they are here grouped together.

It is hardly ever advisable to have statements of administrative and selling expenses made up in the cost department proper. For this reason they are used directly in the profit and loss statement and may be put in the statement itself, or may be cared for by subsidiary statements with simply one item in the profit and loss statement for each.

In the case of the particular system here described these two subsidiary statements are made up of the charges to the standing order codes provided for each of these divisions, together with any general charges which may come through other expense accounts.

### **Financial Section of Profit and Loss Statement**

In the financial section of the profit and loss statement appear the following headings :

1. Discount Taken
2. Interest Received
3. Dividends Received
4. Discount Given
5. Interest Paid

It may be well to discuss briefly some points in connection with these accounts, particularly in connection with the fact that they should always be shown separate in the profit and loss statement, and not included either as a debit or credit to any expense account which is included in the cost of goods.

1. *Discount Taken.* In many manufacturing plants the discount taken on purchases has been deducted from the invoice price of the material and the material entered on the stock records at the discounted value. This is believed to be bad practice.

The discount referred to, it should be remembered, is merely the cash discount taken on account of paying bills promptly. It is not to be confused with trade discounts which

are involved in actually adjusting the price at which the material is bought in the first place. The cash discount is purely a financial transaction. The reduction of the cost of the product is made possible merely because the company is in such a prosperous condition that they have cash enough to discount their bills. The cash discount, accordingly, should be a direct credit to the Profit and Loss account in the financial section as an added profit to the company on account of being able to pay bills promptly.

2. *Interest Received.* Interest received is also a straight profit derived from good financial management, and may be received as a result either of open accounts or of large bank balances or loans. Interest should not be credited to anything other than the straight Profit and Loss account. It usually acts as an offset to transactions which affect the Profit and Loss account in the opposite way as explained later.

3. *Dividends Received.* Many times a manufacturing plant is successful to the point where it is possible to invest money in the stock of another company from which dividends are received. Such dividends most certainly constitute a straight profit and loss item, being a financial profit which accrues from the fortunate situation of being able to make the investments.

4. *Discount Given.* The cash discount allowed customers who pay their bills on a cash or short-term basis is unfortunately often included in the selling expense section. It is argued by many that the cash discount is a deduction from the price at which the goods were sold and therefore should be debited as an expense, entering into the final cost of the goods through the medium of the selling expense.

While it is, of course, important to safeguard the affairs of any company by crowding into the cost all possible items, the true theory here is that the selling expense should *not* be burdened with this cost. In fact, a selling department which is jealous of its costs most certainly has reason to object to

this item being put in as a part of the expense incurred in selling goods. Whether the account is paid in a week or 10 days or net 30 days, is indeed a matter of no interest to the selling department. In fact, in such a case a selling department would be quite justified, with customers of good credit, in recommending them to pay in 30 days, so that the selling cost should not be burdened with the cash discounts which might be taken.

Discount given should certainly be a debit to the Profit and Loss account in the financial section. The discount is merely an inducement offered by the financial department of the business to obtain quick money returns on sales made, and thereby be enabled to make a much faster turnover of the company's working capital.

5. *Interest Paid.* The disposition of interest in the general accounts has been much debated. While a company will have entries in both the Interest Received and the Interest Paid accounts, the entries appear in volume in only one of the two accounts. If a company is prosperous, the preponderant entries will be in the Interest Received account; on the other hand, if the company is not well fixed financially, and is therefore obliged to borrow from banks to a considerable extent, the natural result will be a preponderance of entries in the Interest Paid account.

Interest received is rarely credited either to any administrative expense account or to any other account except as a straight profit and loss item. That being the case, why should interest paid be included in the administrative expense?

Interest paid is largely brought about by the fact that a company has not sufficient capital to take care of its financial obligations properly. On the other hand, the usual reason for borrowing money is that a company does not care to increase its capital stock, as it is figured that money can be borrowed at 6%, and that a manufacturing profit of, say 15%



or 20%, can be produced, leaving a net additional profit of from 9% to 14% to go into dividends for the existing stockholders, instead of dividing this additional profit with the additional stockholders who would participate if the capital were increased to obviate the necessity of borrowing the money. It would seem quite proper, accordingly, to class interest on borrowed money as a *reduction of dividends*, this being the actual result as outlined above.

The suggestion has been made that placing the interest paid in the administrative expense will permit the recovery of the interest as part of the cost before the selling price is set. This is a very fine plan in theory and perhaps in some cases works all right, but not in the case of two plants manufacturing identically the same product, by identically the same process, and with approximately the same grade of organization.

One of these plants has no need of borrowing money, whereas the other is undercapitalized and is obliged to borrow a good deal. Their manufacturing costs up to the administrative expenses may be regarded—for the sake of a highly competitive illustration—as the same. The result, therefore, is that the company with plenty of capital has an administrative expense lower by the amount of the interest which the other company is obliged to pay and which is added to its administrative expenses.

Each company sets its selling price on the basis of a percentage added to their total cost, which immediately places the selling price of the company which is short of capital at a figure somewhat higher than the other company. Only one result occurs, namely, that the company with the higher price loses the business, and the fine theory in regard to the recovery of the interest vanishes in the cold fact of lack of orders.

A company with large bank loans may attempt to put its interest into its costs and may temporarily succeed. A time

arises, however, when the banker suggests that the lines of credit are too large and that an issue of preferred stock should be put on the market. This is done. The result is that the very same interest which was paid on the bank loans is now paid as dividends on preferred stock and the administrative expense is immediately relieved of the charge which it has been standing for the interest on the borrowed capital. Is this illustration alone not sufficient to convince one of the fact that interest on bank loans are really in the line of a deduction from dividends?

The main point, however, is that it is a real and serious fallacy to believe that the inclusion of interest on loans in the administrative expense is a means of recovering this interest as against competitors who sell goods without such a charge in their costs. To include the interest in the cost is in reality dangerous in the extreme as affecting the volume of business. While it may not be noticed in any particular cases, the company is actually put into sharp competition with companies who are not subject to such a volume of interest on borrowed capital. Therefore, it seems beyond question that interest paid on bank loans should be a direct profit and loss item and should not be included in any way in the cost of the goods.

### 3. Burden Statements

Next following the profit and loss statement, with its subsidiary statements, should follow the burden statements in the order of the departments as specified in the standing order code. (See Chapter VII.) An illustration of a burden statement is shown on page 315. The number of these statements will depend entirely on the number of departments which require a statement of their burden.

Each statement will be numbered or lettered at the top with its designating number or letter, which is its identifying reference in the plant balances statement, the net result of which

is shown in the profit and loss statement under the heading "Plant Balances." These identifying letters are also used in the distributions made in the expense accounts which follow.

Each burden statement is made up of the three main sections, namely: burden labor, maintenance and supplies, and apportioned expenses. In the burden statement shown on page 315, the large group of burden known as "Maintenance and Supplies" is shown under two headings: "Maintenance" and "Sundry Expense Material." Under the apportioned expenses, each item is followed by a reference to the expense statement whence it comes, to enable quick reference. The over- and under-absorbed balances of each burden account will have the reference letter showing the statement to which this balance was carried in the Profit and Loss.

#### **4. Expense Accounts**

Immediately following the burden accounts will be the various expense accounts arranged in the same sequence in which they appear in the standing order code—as illustrated on page 316.

In these accounts, there are two main sections, the first being the charges made directly to the account, and the second being the apportioned charges.

Here again, the index letters will be used to show the origin of certain charges which are made to the accounts and the accounts which are charged by the distribution of the expense accounts.

#### **Reading the Statements**

Consider the position of a manager receiving a set of statements for the month.

It is natural, first of all, to look at the profits in the balance sheet to see how much money was made during the month. It is assumed that this profit was either larger or

smaller than anticipated—on the basis that a manager is usually either surprised or disappointed. At the same time the manager has been quite concerned over the amount which it has been necessary to borrow from banks, and therefore wishes to find out why the bank account is so small.

He therefore first glances at the raw material and manufactured stock inventory in the balance sheet and discovers that it has gone up very materially during the month. He then turns back to the statement which shows the detail of inventories and discovers that the steel stock took a decided jump of, say, over \$60,000.

He immediately rings for the purchasing agent and receives the explanation that a lot of old stock orders had been received and paid for during the month. He also learns that in the meantime certain orders for spot delivery had been placed to keep the plant going, and that this material was in reality surplus stock which was largely unnecessary.

It then becomes a purely executive matter not only to decide what to do about this particular material, but to survey the conditions of other outstanding orders, in order to curb the amount of material coming in if the financial conditions of the concern so demand.

He then gives attention to the fact that the profit is smaller than was anticipated. Turning to the profit and loss statement (page 314) for an explanation, he sees that the shipments have been normal and that apparently the percentage of profits at standard rates of burden is satisfactory. But in looking at the plant balance he finds a heavy penalty in underabsorbed overhead which leads him to turn to the subsidiary statement of plant balances for an explanation. Here he finds that in four or five of the most important departments there is a very large amount of underabsorbed burden which accounts, to a considerable extent, for the penalty in the profit and loss account.

He therefore turns back to the burden accounts of these particular departments and he finds that the actual expenses of the departments were on a normal basis, but that the productive hours of work accomplished during the month were very low—in fact much lower than the preceding month. He now has located the cause of the losses, but this, of course, is as far as the financial statements can go.

He therefore calls for the general superintendent to explain the conditions, who in turn calls for the manager of the industrial relations department to account for the heavy decrease in productive hours. It is learned that in one department the foreman has not treated the men very well and as a result he has had a very heavy turnover.

He also learns that in another department the help has been largely made up of a certain nationality who have become very independent and have during the month availed themselves of many holidays on account of events of special interest to their people.

In other departments he finds other features of labor conditions which may or may not account for the heavy shortage in the productive hours applied in the plant.

He is in a position, therefore, to expect action on the part of the industrial relations department and of the general superintendent, perhaps by changing the foreman in the department where the men cannot get along, and by taking steps to sprinkle in different nationalities in the department where there was a large concentration of one element, in order to stabilize conditions there.

In turning back to the expense accounts, the manager also notes that the Electric Power account has increased to a very considerable degree during the last month.

He then remembers that the power company has been able to secure a large increase in rates. He realizes that the result in his expense account is such an increase as to make it appar-

**HOLDEN MANUFACTURING COMPANY (A)**  
**CONDENSED BALANCE SHEET, JANUARY 31, 1920**

*Assets*

**Current Assets:**

Cash on Hand and in Banks.....	\$0000.00	
Bills Receivable.....	000.00	
Accounts Receivable—Customers.....	000.00	
Accounts Receivable—General Ledger.....(D)	00.00	
Liberty Bonds.....(E)	\$ 0000.00	
Other Bonds.....(E)	0000.00	0000.00 \$ 0000.00

**Merchandise Assets:**

Raw Material and Manufactured Stock.....(F)	\$ 000.00	
Material in Process.....(F)	000.00	0000.00

**Plant Assets:**

Machinery and Equipment.....	\$ 000.00	
Real Estate and Buildings.....	000.00	0000.00

**Miscellaneous Assets:**

Prepaid Items.....	\$ 000.00	
Other Investments.....(E)	0000.00	
Good-Will.....	0000.00	0000.00

Total Assets.....\$00000.00

*Liabilities*

**Current Liabilities:**

Bills Payable.....	\$0000.00	
Vouchers Payable.....	000.00	
Accounts Payable—General Ledger.....(G)	00.00	
Accrued Pay-Roll.....	00.00	
Accrued Miscellaneous.....	00.00	\$ 0000.00

Reserves.....(H) 0000.00

**Capital Stock:**

Capital Stock, Common.....	\$0000.00	
Capital Stock, Preferred.....	0000.00	0000.00

Surplus, January 1, 1920.....\$0000.00

**Less:**

Income and Profits Tax, 1919.....	\$ 0000.00	
Dividends, Common.....	0000.00	
Dividends, Preferred.....	0000.00	
Adjustment Account.....(I)	000.00	0000.00
		<u>\$0000.00</u>

**Plus:**

Profits to January 1, 1920.....	\$ 000.00	
Profits of January, 1920.....(C)	0.00	0000.00 0000.00

Total Liabilities.....\$00000.00

(B)

## HOLDEN MANUFACTURING COMPANY

## COMPARATIVE BALANCE SHEET, JULY 31, 1920

## Assets

	End of Last Year	End of Last Mo.	End of This Mo.	Last Mo. Increase—Red Decrease—Blk.	Last Yr. Increase—Red Decrease—Blk.
	Dec. 31, 1919	June 30, 1920	July 31, 1920	Increase	Decrease
<b>Current Assets:</b>					
Cash on Hand and in Banks.....	\$ 0000.00	\$ 0000.00	\$ 00000.00	\$ 000.00	\$ 000.00
Bills Receivable.....	0000.00	0000.00	0000.00	000.00	000.00
Accounts Receivable—Customers.....	0000.00	0000.00	0000.00	000.00	000.00
Accounts Receivable—Gen. Ledger (D).....	0000.00	0000.00	0000.00	000.00	000.00
Liberty Bonds.....(E)	0000.00	0000.00	0000.00	000.00	000.00
Other Bonds.....(E)	0000.00	0000.00	0000.00	000.00	000.00
	\$ 0000.00	\$ 0000.00	\$ 00000.00	\$ 000.00	
<b>Merchandise Assets:</b>					
Raw Material and M'fact'd Stock (F).....	\$ 0000.00	\$ 0000.00	\$ 00000.00	\$ 000.00	
Material in Process.....(F)	0000.00	0000.00	0000.00	000.00	
	\$ 0000.00	\$ 0000.00	\$ 00000.00	\$ 000.00	
<b>Plant Assets:</b>					
Machinery and Equipment.....	\$ 0000.00	\$ 0000.00	\$ 00000.00	\$ 000.00	
Real Estate and Bldgs.....	0000.00	0000.00	0000.00	000.00	
	\$ 0000.00	\$ 0000.00	\$ 00000.00	\$ 000.00	
<b>Miscellaneous Assets:</b>					
Prepaid Items.....	\$ 0000.00	\$ 0000.00	\$ 00000.00		\$ 000.00
Other Investments.....(E)	0000.00	0000.00	0000.00		
Good-Will.....	0000.00	0000.00	0000.00		
	\$ 0000.00	\$ 0000.00	\$ 00000.00		\$ 000.00
<b>Total Assets</b> .....	\$ 00000.00	\$ 00000.00	\$ 00000.00	\$ 0000.00	

# FINANCIAL STATEMENTS

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## Liabilities

	End of Last Yr.	End of Last Mo.	End of This Mo.	Last Mo. Increase—Red Decrease—Blk.	Last Yr. Increase—Red Decrease—Blk.
	Dec. 31, 1919	June 30, 1920	July 31, 1920	Increase	Decrease
<b>Current Liabilities:</b>					
Bills Payable.....	\$ 0000.00	\$ 0000.00	\$00000.00		\$ 000.00
Vouchers Payable.....	0000.00	0000.00	00000.00		000.00
Accts. Payable—General Ledger....(G)	000.00	000.00	0000.00		00.00
Accrued Pay-Roll.....	000.00	000.00	0000.00	\$ 000.00	
Accrued Miscellaneous.....	00.00	00.00	000.00		00.00
	\$ 0000.00	\$00000.00	\$ 00000.00		\$0000.00
<b>Reserves.....(H)</b>	\$ 0000.00	\$ 0000.00	\$ 0000.00		
<b>Capital Stock: Capital Stock, Common...</b>	\$ 0000.00	\$ 0000.00	\$ 0000.00	\$ 000.00	
Capital Stock, Preferred..	0000.00	0000.00	0000.00		
	\$00000.00	\$00000.00	\$00000.00		
<b>Surplus, January 1, 1920.....</b>	\$ 0000.00	\$ 0000.00			
Less:	\$ 0000.00	\$ 0000.00			
Income and Profits Tax, 1919..	0000.00	0000.00		\$ 000.00	
Dividends, Common.....	0000.00			000.00	
Dividends, Preferred.....	0000.00	0000.00			
Adjustment Account.....(I)	000.00	000.00	\$ 000.00		
	\$ 0000.00	\$ 0000.00	\$ 0000.00	\$ 000.00	
<b>Surplus Less Deductions.....</b>	\$00000.00	\$00000.00			\$0000.00
<b>Plus:</b>	\$00000.00	\$00000.00	\$ 0000.00	\$ 000.00	
Profits to 1st current month....	0000.00	0000.00	000.00	00.00	
Profits of July, 1920.....(C)	\$00000.00	\$00000.00	\$ 0000.00	\$ 000.00	
	\$00000.00	\$00000.00	\$ 0000.00	\$ 00.00	
<b>Surplus as of July 31, 1920.....</b>	\$00000.00	\$00000.00	\$00000.00	\$0000.00	
<b>Total Liabilities.....</b>	\$00000.00	\$00000.00	\$00000.00		



HOLDEN MANUFACTURING COMPANY  
(C)  
GENERAL PROFIT AND LOSS, MONTH OF JANUARY, 1920

	Total to Date	Jan., 1920	Dec., 1919	Increase	Decrease
Total Sales.....(J)	\$000000.00	\$000000.00	\$000000.00	\$00000.00	
Freight Out on Sales.....(J)	000000.00	000000.00	000000.00	00000.00	
Net Sales.....	000000.00	\$000000.00	\$000000.00	\$00000.00	
Total Sales Cost.....(J)	000000.00	000000.00	000000.00	00000.00	
Gross Profit.....	\$000000.00	\$000000.00	\$000000.00	\$00000.00	
Plant Balances.....(K)	00000.00	00000.00	00000.00	0000.00	
Net Manufacturing Profit.....	\$000000.00	\$000000.00	\$000000.00	\$00000.00	
Administrative and Selling:					
Administrative Exp.....(L)	\$ 00000.00	\$ 00000.00	\$ 00000.00	\$ 0000.00	
Selling Expense.....(M)	00000.00	00000.00	00000.00	0000.00	
	\$000000.00	\$000000.00	\$000000.00	\$00000.00	
Profit above Mfg. Cost, Admin., and Sellg. Financial:	\$000000.00	\$000000.00	\$000000.00	\$00000.00	
Discount Taken.....	\$ 0000.00	\$ 0000.00	\$ 00000.00	\$00000.00	\$00000.00
Interest Received.....	0000.00	0000.00	00000.00	00000.00	
Dividends Received.....	0000.00	0000.00		00000.00	
Discount Given.....	0000.00	0000.00	0000.00	00000.00	
Interest Paid.....	0000.00	0000.00	0000.00	00000.00	
	\$ 00000.00	\$ 0000.00	\$ 00000.00	\$00000.00	
Profit above Mfg. Cost, Admin., Sellg., and Financial.....	\$ 00000.00	\$ 00000.00	\$ 00000.00	\$00000.00	
Real Estate:					
Real Estate Income.....	\$ 0000.00	\$ 0000.00	\$ 0000.00	\$00000.00	\$00000.00
Real Estate Expense.....	0000.00	0000.00	0000.00	\$00000.00	
	\$ 0000.00	\$ 0000.00	\$ 0000.00	\$00000.00	
Net Profit, January, 1920.....(A)	\$ 00000.00	\$ 00000.00	\$ 00000.00	\$00000.00	

## 315

(AA)

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(WW)

## HOLDEN MANUFACTURING COMPANY

## TRUCKING EXPENSE, JUNE, 1920

	Jan. 1 to June 30, 1920	Month June, 1920	Month of May, 1920
<b>Trucking Expense:</b>			
G-101 Electric Truck Labor.....	\$ 0000.00	\$ 000.00	\$ 000.00
102 Maint. of or Supplies for Elec- tric Trucks.....	0000.00	000.00	000.00
103 Gasoline Truck Labor.....	0000.00	000.00	000.00
104 Maint. of or Supplies for Gas- oline Trucks.....	0000.00	000.00	000.00
105 Teaming.....	0000.00	000.00	000.00
106 Miscellaneous.....	00.00	.00	0.00
	<u>\$00000.00</u>	<u>\$0000.00</u>	<u>\$0000.00</u>
<b>Apportioned Charges:</b>			
Depreciation.....	\$ 000.00	\$ 00.00	\$ 00.00
Electric Power.....(QQ)	000.00	00.00	00.00
Liability Insurance.....	00.00	00.00	00.00
	<u>\$ 000.00</u>	<u>\$ 000.00</u>	<u>\$ 000.00</u>
<b>Total Expense.....</b>	<u><u>\$00000.00</u></u>	<u><u>\$0000.00</u></u>	<u><u>\$0000.00</u></u>

## DISTRIBUTION FOR MONTH

Dept. 1.....(X)	00.00%	\$ 000.00
2.....(HH)	00.00	000.00
3.....(JJ)	0.00	00.00
4.....(KK)	0.00	00.00
5.....(NN)		
6.....(OO)	0.00	00.00
7.....(MM)	0.00	00.00
8.....(PP)	.00	0.00
		<u><u>\$0000.00</u></u>

ent that the company may well consider the installation of their own auxiliary power plant to take the peak loads, instead of being obliged to pay a large service charge for power which sometimes is not used.

### **Possibilities of Careful Study of Statements**

Limitations of space in this volume prohibit the further analyses of the countless managerial uses which may be made of statements put up in the form specified in this chapter. It would require a volume nearly as large as this discussion of cost methods in general, to cover satisfactorily all the uses of a thorough reading of a proper set of statements.

Above all things, a manager should remember that a comprehensive set of statements can be used by him for a most positive regulation of all conditions. Every manager must remember that it is up to him to perfect himself absolutely in the knowledge of how statements are prepared and how to read them, and that if he should so prepare himself, he is in a position to read the efficiency of every responsible official and department in his institution.

## CHAPTER XXIII

### USE OF COST REPORTS BY FOREMEN

#### Arguments for Publicity of Costs

A well-known firm of industrial engineers has repeatedly made the statement that 80% of the blame in the case of non-production lies with the management, meaning that only 20% of the fault can be in any way attributed to the workers.

This failure on the part of the management extends into many branches of the industrial institution, covering not only failure to provide the means of actually producing the goods, including all manner of devices and equipment for facilitating the movement of goods, but also failure to furnish the foremen and assistants with the proper backing in the matter of records showing what they are accomplishing.

Probably in the great majority of manufacturing institutions today, figures by the thousand are compiled and safely salted away in files where no one makes sufficient use of them to warrant their compilation. In fact, it is quite a prevalent habit for plants to consider that cost figures which have been compiled are purely of a confidential nature, and therefore must not be known by anyone who is interested. This is one of the most fatal mistakes that can be made. Its consequence is that no steps whatever are taken to give superintendents and foremen a real knowledge of what is going on, which will prompt them to better the existing conditions.

#### Importance of Cost Figures to Foremen

The objection is often urged that all such figures are confidential; that if they are released for more or less general knowledge, the figures will leak to someone outside of the

plant, and as a result some competitor may learn something about the business which otherwise he would not know. As a matter of fact, the figures in respect to the various expenses incurred by the several departments of the business are peculiar to that business alone. Even if they were known by someone else, the chances are very much against their being of any particular use. Even within one industry the internal workings of individual concerns are so different that figures pertaining to any one department are absolutely valueless to an outsider.

The conclusion seems clear that withholding from operating superintendents and foremen the figures which would mean so much to them if available in comprehensive and usable form, is plain failure on the part of the management. It is most strongly urged, accordingly, that all possible use be made of cost figures, even to the point of preparing special statements on special forms for the various superintendents and foremen in order that they may know exactly what they are accomplishing.

### **Burden Statements for Foremen and Department Heads**

The head of each operating department should be provided each month with a copy of the statement of his burden for the past month. Form 34 illustrates a form for such a statement.

It will be noted that this form provides for the figures for six months, together with the average of the previous six months. It is not sufficient to supply a man with the figures for a single month. The great value of figures lies in making possible the comparison of present and past. This form enables the recipient to get the true measure of how each item which makes up the burden is running as compared with past experience, both as to money and as to the ratio of each item to the basis used for the application of burden.



The form is quite simple and practically explains itself, so that only a slight description is necessary. The first two columns provide for the standing order numbers and the name of the account, or the work covered by each order. This is followed by the column in which is entered the average of the previous six months.

With the exception of their month headings, the next six blocks are absolutely identical, the amount of money for each standing order for each month, and the per cent of each item to the direct-labor cost being entered in each block. The form shown illustrates the use of the percentage on the direct-labor cost basis rather than on the direct-labor hour basis. If the direct-labor hour basis is used, this heading would read "per hour" instead of "per cent." The third column in each block shows the average per cent from the beginning of the six months' period for each item.

In entering figures on the form, all percentages which are higher than the figure for the same item for the previous month are entered in red. In other words, if an item showed \$300 last month and \$320 this month, the \$320 would be entered in red. If it should have happened that the direct labor had also increased and the percentage of this item for the month had decreased, the percentage would be entered in black. If, however, the percentage had increased, as well as the amount of money, the percentage would be entered in red.

By means of this device attention is directed graphically to all figures which are increasing, which make it far easier to detect the matters in the report which need attention.

The amount of money can easily increase and yet the result be satisfactory. This, however, will be plainly indicated by the percentage or the cost per hour, whichever is used. It is perfectly natural for a business which is increasing to have larger sums of money spent for each item, but so long as the ratio of this expenditure and the direct or productive work



which it is serving stays the same or diminishes, the department is running in a way which is to be commended.

### **Use of the Burden Statements**

If a careful study is made of the comparative burden report just described, it may easily be seen what far-reaching benefits will accrue from its use. The one thing never to lose sight of is that any expense or burden account is made up of small units. Proper regulation of these small units, constant watching of everything that contributes to each of them, and constant vigilance in keeping down the expenditures for every one will decrease the burden cost of the business to an extent which will indeed be surprising.

To give merely one illustration, in the majority of industrial plants, the mechanical work is under the jurisdiction of a master mechanic. The various repair men are detailed from one department to another as their services are needed. These men being under the jurisdiction of the master mechanic are, unfortunately, regarded by the foremen of the various operating departments as being of no particular interest to them. This feeling can be entirely eliminated if the foremen are provided with the statement of their monthly expenses on Form 34, where they can see the amount of money with which they are charged for maintenance of equipment in their department.

An instance of this was noted in a large plant where a foreman, on receiving his first statement of his burden expense for the previous month, was instantly struck with the size of the charges to his department for the repairs of certain equipment. He came to the cost office and protested that the repair men spent most of their time sitting around and talking and that the actual repair work only took a few hours.

The net result, however, was that this foreman realized in a way that he never did before that, while the men con-

nected with the master mechanic's staff were detailed to his department, they were in reality his own men, since he had to pay the bills for the time they were there. It is needless to say that thereafter he paid just as much attention to any outside men who were in his department as he did to the men directly on his pay-roll, knowing that he had to pay the bills in his burden account for all the time so spent.

### **Use of Burden Statements Becomes a Game**

The remark has been made in many plants, after the foremen have been given regular comparative statements of their monthly burdens, that the operation of their departments was like playing a game. By this they meant that they looked forward to receiving these statements with almost as much interest and anticipation as in watching the score-board at a baseball or football game. Many foremen have expressed the opinion that it was even more interesting than any game of amusement could possibly be.

In one instance which came under observation, a number of men collaborated in the designing of a variable speed drive for emery wheels, the purpose of which was to keep the speed at the circumference of the emery wheel identically the same as the wheel wore down. After the installation of the machines it was a constant pleasure to see the expense for emery wheels decrease. Far greater efficiency could be obtained from the wheels through keeping them up to speed, and they could be worn to a much smaller diameter by increasing the speed as they wore down. The net result was a decrease in the emery wheel expense of over 80%, an item which amounted to many tens of thousands of dollars to this department in a year's time.

Every item making up the burden is subject to treatment of the same nature. A careful study of the circumstances in connection with each one will easily develop some method of

reducing cost, and as a result of the various schemes worked out the monthly statement does in reality become a score-board to record the result of the industrial game which is being played.

### **Watching Direct-Labor Cost**

Keeping track of the direct cost is different from keeping track of the indirect cost. To determine how the direct cost is best watched, depends very largely on whether or not the manufacturing plant is running under a method of production control.

When a method of production control is followed, and the various direct operations are carefully scheduled at standard rates, the natural way of controlling the direct operations is to keep in constant touch with performance as shown by the control methods. Each operation on each piece, whatever the line of industry, should be subject to some approved standard of speed—a certain number of pieces per hour or per day, as may be best.

With this method it is necessary—and fair enough—to wait until an order is completed before knowing exactly how that order is running in comparison to the speed estimated for it, on the basis of past experience. The superintendents and foremen should, however, be given the advantage of seeing the actual cost sheets on each completed order, so that they may see exactly how successful their department has been in producing the work assigned. Even without being able to watch the progress of the work as it goes on, there is a psychological effect produced by looking at the completed cost sheet, whereon the final result is shown as a result of the actual circumstances which prevailed during the run.

In any business doing a large amount of rapid work, the detailed cost of each run should be entered on a comparative cost sheet, as illustrated in Form 38. This comparison will

show, side by side, the unit time and cost for each operation and for each period where this particular unit has been in use. Fluctuations in direct cost are the net result of different workers who may run the same machine or perform the same operation. A very careful study should be made as to the resulting cost as shown on the comparative sheet. Many times this comparison will bring out possibilities of eliminating the more serious fluctuations—and perhaps reducing time and cost—through careful examination and revision of operating methods.

### **Watching Direct-Material Cost**

The direct-material cost will also show on the cost sheet of the completed goods, and here again attention should be paid to maintaining the standard cost. Among the most frequent reasons for diverging from the standard cost are:

1. Inability to secure the standard material.
2. Increase in cost of the standard material.
3. Large spoilages of material.
4. Waste on account of using wrong size of material.

It often occurs in making some product that too expensive material of a given size is used. This may be the fault of the operating department which has chosen the wrong material, or it may be the fault of general business conditions which make it impossible to obtain the right kind of material. In either event, the foreman should know exactly what has happened, so that in the future he can choose more wisely, if the fault is his own, or can see that the purchasing department supplies him with the proper kind of material.

As for all the other faults—spoilage, etc.—it is entirely the duty of the foreman to eliminate to the greatest possible extent such causes as tend to increase the cost of the product in his department. It should be evident, however, that no fore-

man can properly or intelligently act in the best manner unless he is thoroughly posted in respect to what goes on. For this reason it is urged that superintendents and foremen be given constant access to the cost records in order that they may be fully posted in respect to all that happens.

## CHAPTER XXIV

### PREVAILING TYPES OF COST SYSTEMS

#### Selecting the Type of System—Importance of the Base

In Chapter III, the necessity was pointed out of establishing the basis for figuring costs before any move was made in planning the methods to be followed—the extreme importance, that is to say, of establishing first of all the various points which must prevail in guiding the compilation of figures, in order to produce in a given case the most usable set of costs when the final objective is reached.

It is indeed exasperating to have a cost system supposedly in full swing, and then find out that the figures are so bunched together that they do not give the details which are requisite if costs are to be used to the utmost limit.

#### Types of Systems Classified

The type of cost system under which a plant or department is operated may be identified according to the preponderance of one or another kind of base.

The different types of cost systems are in reality very few, and it might be said that there is hardly any industrial plant which is really using any one method. In the majority of cases, perhaps, the systems employed make use of all the types here mentioned.

The prevailing types are:

1. Job cost method
2. Class cost method
3. Operation cost method
4. Process cost method

### 1. Job Cost Method

When all the various items of cost are charged up to the particular order embracing a specific quantity of a specific unit, the method is known as the "job cost method."

By this method any kind of labor or other direct cost is charged to a particular order number and all the charges against a particular order number constitute the cost of the order when it is figured up.

An illustration of this method would be an order for a shaft in a machine-shop. The forging for the shaft is received from another plant and is drawn from the stockroom on requisition, this order being charged with the number of pieces involved. All the machine operations, such as cutting off, turning, and key-seating, are charged against this particular order number on completion of the order. The figuring of the total cost of the order would involve computing the time and cost of each operation, the burden, and the material cost. Dividing this total by the total number of pieces produced gives the cost for producing each unit of the material called for by the order.

### 2. Class Cost Method

In many lines of manufacture it is possible to save much detail by disregarding individual order numbers, and instead of compiling the labor directly for these order numbers, grouping all order numbers—so far as the material they represent permits of such combination—into one large statement of costs.

A very clear example of this may be noted in a foundry. It is often the case that articles up to one pound in weight constitute a convenient class. The cost of all castings produced within this range of weight are accordingly bunched into one cost sheet, thereby saving the necessity of making out an individual cost sheet for each separate casting. Further

classes are made up, covering castings from one to two pounds, from two to five, or from five to ten, and so on. In addition to the weight distinction, of course, these classes may be subdivided, for greater accuracy, into perhaps three subclasses, designated as A, B, and C, which vary according to the classified difficulty of coring and moulding.

Some foundries have a total of fifty classes only to which all material, labor, and burden are charged, necessitating but fifty cost sheets per month. The cost of any particular casting is determined by the class to which it belongs.

It might be stated, however, that in nearly every foundry using class costs, the moulding and core-making item for each casting is reported separately, so that in case of doubt it is possible at any time to compute the cost of any individual casting. The regular costing, however, is confined to the classes.

### 3. Operation Cost Method

The type of costs known as "operation costs" are in the main quite different from class costs. The operation type of cost-figuring deals principally with the computing of the cost of a certain operation in plants where this operation is common to a large amount of product.

In the manufacture of storage batteries, for example, the cost of forming is in direct ratio to the square inches of surface formed. One forming row may consist of many different kinds of plates, but the electrical energy used is in direct ratio to the square inches of plate exposed. Therefore, the cost of current, of setting and taking out the rows, and all other costs, are kept for each run, and a tally is prepared of the square inches of plate surface formed. These records are kept in continuous form so as to provide a monthly cost per square inch for the formation of plates, which cost is used both for estimating and for actual costing.



In a planing-mill, the rip saws may best be regulated if the cost of this operation is kept, figuring it on the basis of lineal feet of work performed.

In a hat business, the operation of sewing in sweatbands is an operation that is the same for any hat made. This cost may best be figured accordingly on the basis of the single hat as a unit.

#### 4. Process Cost Method

In many lines of work, particularly in industries of the chemical type, the process method of cost prevails.

The production of a chemical plant is almost entirely of the process nature; many of the steps which might be regarded as operations are not clearly enough defined to permit each operation to be checked at its conclusion.

For instance, in a phenol plant the first operation, strictly speaking, is sulphating the benzol. The resulting product of this operation, however, is blown over at once to the lime vats, from here through the filters, and so on through every operation until it reaches the drum dryer, where the production reaches a measurable point in the shape of the salt. Therefore the operations, from the start to the taking of the dry salt from the drum dryer, have to be treated as one process, and as no costs can be found on the individual operation through lack of the proper basis for figuring, the result is a process cost including all the operations thus far. The process of manufacture of phenol continues in somewhat the same way, until the phenol itself results from the final operation of distillation.

The process cost, therefore, may be defined as a combination of operation costs, usually brought about by the inability to arrive at any basic weight or measure for gauging the intermediate operations involved, thereby making possible costs by groups of operations only.

### Choice of a Cost Method

It is always advisable to settle on some standard type of cost system to be installed in a plant—so far as the choice is possible. This is sometimes a most difficult task. The operation and process are often used extensively in the same plant, largely because they are so nearly alike, the process method being really a composite operation method.

In making a survey of a plant for the purpose of deciding upon the best type of system, it is necessary to investigate very carefully the equipment of the plant and the methods actually used in producing the goods.

In many plants will be found automatic machines known as "single-purpose machines" for performing certain operations which cover a very short range. As these operations are highly specialized and largely automatic, it is easy to see that the operation method should be used in figuring their cost.

The term operation need not be limited to work on one kind of material only, provided it is possible to figure the cost per stroke, per lineal inch, per piece, etc. An example of this appears in the case of the punch press. This machine runs at a constant speed, and the most usable cost record that can be assembled for this operation is on the basis of the number of strokes per hour productively employed. The record of strokes gives a direct line on the efficiency with which the machine is being operated. The case would be the same with any class of machine which maintains a steady stroke per minute.

In a boiler-shop, the cost of shearing is often figured on the basis of the lineal feet sheared per hour. This number varies, of course, according to the size of the material handled, but in the main it gives a very good basis for controlling the efficiency with which the machine runs. It also gives a very accurate line on the cost, as the number of lineal feet sheared per hour will come much nearer to a standard than would the

size or shape of the pieces being sheared, even though the shapes cause a variance in lineal costs.

On the other hand, with many kinds of material the operations on one kind bear no relation whatever to those on another kind, although they may be somewhat of the same nature. Many pieces of material may undergo operations of identically the same nature, and yet, while each operation may be performed on the same machine, there will be no relation between them. Manifestly, then, this class of material would come solely under the job cost type of cost-figuring.

About the only relief which can be obtained in applying the job cost system is the employment of the class cost, which of course has its limitations. Class costs may be employed only in cases in which the several operations are similar, as illustrated in the case of the foundry.

If the equipment in any plant manufacturing small tools, such as taps, dies, drills, etc., were absolutely standardized, there would be the possibility of creating a number of sizes within a certain range, in which the labor and overhead cost would be the same for each class. Great care, however, must be taken to make certain that the equipment is such that the resulting cost of making the product is standard. When different equipment is used even the same operations result in different costs.

### **Combinations of Various Types of Cost Systems**

In most plants, as has been stated, it is necessary to employ to some extent at least two of the types of cost systems, namely: the job cost, and the operation cost systems. Frequently a third type must be employed also—the process cost—and in the case of a foundry probably a fourth type—class cost—as well.

In plants manufacturing such products as rubber, textiles, or paper, and in rolling-mills, etc., it is of the utmost advan-

tage to use the operation cost method, as the comparisons which it constantly presents reveal the efficiency with which the equipment is being used. At the same time, excepting in plants where the product is sold just as it comes from an individual operation, assembly costs usually necessitate some use also of the job cost system.

This may be especially noted in tire-manufacturing, where after the individual operations have been performed the final operation of building the tire is purely an assembly proposition. Even in this case, however, the several operations of building and finishing the tire may be segregated, thereby carrying the entire process through on the operation basis.

The highly specialized operations in connection with the manufacture of clothing have put this industry into the class of operation costs, although in this case some combination with the job cost system is often necessary.

Machine-shops almost invariably use the job order type of cost work, combining with it the operation cost system to some extent.

A candy plant generally uses the system of operation costs. Even the packing, though it might be construed as assembly, can be treated as an operation.

A power plant uses the process type of cost system, and in a manufacturing plant many of the indirect operations involving steam, electric power, compressed air, etc., may be treated somewhat similarly.

### **Stocking Points**

Whatever type of cost system is used, careful thought must be given as to where individual and assembled parts should be stocked.

To attain the best results, individual parts which enter into assemblies must be actually placed in a finished parts stockroom. This is necessary for two reasons: (1) to con-

trol the recording of the completion of the parts; and (2) to control the parts after being completed, with sufficient supporting data on the stock records to regulate properly the material for assemblies or shipment purposes.

A great many plants have attempted a method of "theoretical stocking," regarding parts as theoretically going into stock at the conclusion of certain operations, the idea being that it is useless work actually to transport the parts to a stockroom. The reasoning is fallacious. Actual stocking of the parts is of the utmost importance for accounting purposes as explained above.

Furthermore, it is the only way to use floor space economically, for material can be placed on shelves and stacked up, perhaps ten or twelve layers deep, instead of in a single layer when left on the floor or stacked on benches in the operating department. The floors and benches of an operating department should not be a storage place nor a place in which to accumulate material awaiting a different kind of procedure, such as assembly. This applies equally to the sub-assemblies as they are produced. In the automobile industry, for example, it applies to the carburetors, generators, and other small units which eventually enter into the final assembly of the complete automobile. All such assemblies should be stocked in a stockroom subject to requisition, and should be issued only on specifications of further assemblies. Accurate specifications of product as to assemblies are entirely impossible of accomplishment in actual practice unless the material is properly stocked. It is economy in every way to put this material in stock.

Theoretical stocking might be followed provided every part which goes into an assembly came through at exactly the same time and reached the assembly floor in company with its companion parts. In actual practice, however, this is never the case. Under the very best of methods, parts will straggle

along, although with production control they come very much closer together than when there is no accurate method of scheduling work.

It is sometimes difficult to decide just when the product should be stocked. The time to do this is usually after the completion of an order authorizing a particular phase of the work, that is, when a different stage of production is reached.

In Chapter III it was explained that in the manufacture of pipe the finishing operations were entirely the same up to the time the crop ends were cut off, but that at this point the lengths of the same kind must be considered as going into stock, thence to be issued on the various orders for different kinds of threads and finish. In this case it is, of course, impossible actually to place the pipe in stock. There are a few similar exceptions to the rule of physically stocking material, but they are confined entirely to product which is of enormous volume. As a matter of fact, work on such material is usually a continuous flow proposition of like parts, and so is not complicated by the multitudinous details of many parts, such as are manufactured in a machine-shop, for example.

In any event great care must be taken to keep constantly in mind the necessity of stock record control.

### **Forwarding Slip**

In connection with the matter of stocking material, and also that of delivering material from one department to another, when the operations are continuous, a forwarding slip (Form 35) is an absolute necessity.

This form is simply a record of forwarding from one department to another or to a stockroom, with a description of the material and the signature of the person receiving the material.

The form is used in triplicate; the original copy, which may be salmon in color, goes with the goods; the duplicate

copy, which may be yellow, goes direct to the stock record department, where it is held until the original comes in properly receipted as a check on the receiving of same; the triplicate, usually a white tissue copy, remains in the hands of the person who forwarded the goods.

<b>HOLDEN MANUFACTURING CO.</b> BOSTON, MASS.	
<b>FORWARDING SLIP</b>	
From _____ Date _____ Order No. _____	
Number of Pieces	Description
Sent to _____ Received by _____	

Form 35. Forwarding Slip. (Size, 6 x 4.)

### Job Order Cost Sheets

Forms 36 and 37 show two cost sheets commonly used with the job order cost system.

Form 36 shows a cost sheet used for individual parts. In this case the information desired concerns the operations required to make the parts with a minimum of data, usually not more than one line regarding the material cost.

Form 37, on the other hand, shows the cost sheet for assembled parts. In this case the information regarding material takes up the bulk of the sheet, while the labor operations are of less account.

**Form 36. Individual Part Cost Sheet. (Size, 9½ x 12.)**





Form 38 shows a comparative cost sheet on which is to be entered the information in connection with all the runs

**Form 38. Comparative Cost Sheet. (Size, 8½ x 11.)**

The use of this sheet will give the variations in the cost of running each operation on each piece and is of the greatest value in showing the actual cost of production. This sheet is the one which foremen should be invited to inspect at regular



intervals for all the product which comes under their particular control.

### **Foundry Individual Piece and Class Cost Sheets**

Form 39 illustrates a cost sheet to be used for figuring the cost of individual castings. It may also be used for figuring the cost of classes of castings, as the method of figuring is identically the same.

In this cost sheet the total metal poured is first entered, with credit given for the bad castings and sprue at scrap price, which leaves the net cost of the metal used in the casting or class. Next follow the details in regard to the moulding and core-making labor, together with their burden and any machine time and machine rates which may be employed on the job. Next comes the finishing cost by percentage on the moulding and core labor, together with the annealing cost at a price per pound.

The sheet is by no means intended to be represented as fitting all cases, but simply illustrates a cost sheet as used for a medium-sized foundry for both individual patterns and classes.

### **Operation Cost Sheets**

In compiling costs under the operation method, it is necessary to pay particular attention to two very distinct phases:

1. Setting up a code of operations, the cost of which are to be kept.
2. Providing a sheet for recapitulating the quantities performed each day under each operation.

How these two items are taken care of is shown in Form 40, a production and cost record of tubes. One of these sheets is used for each size of tube.

The total production for each day is entered on this sheet. The total of the labor charged up against each operation code



number as shown under operation is ascertained from the time cards at the close of the month and entered under the heading "Total Labor Cost." It is then a matter of routine to fill in the cost per 100 tubes. The burden applicable to all operations in this department is entered below the total cost, thus arriving at the total labor and burden cost of each size of tube for the month. The material cost is entered on the bottom of the sheet, together with the credits for rubber scrap. As a result of the previous calculations, the net material and total manufacturing cost is shown.

### **Process Cost Sheets**

No illustration of the process cost sheet is shown, because it is almost exactly the same as an operation cost sheet, differing only in the titles on the sheet. Each operation would be a process in itself, the total of the entire list completing a major process which brings the material up to a point where it is measurable for cost purposes.

## CHAPTER XXV

### BY-PRODUCT COSTS

#### **Problem of By-Product Accounting**

A part of the accounting under a process system has to do with the accounting for the costs of by-products. By-products arise chiefly in the continuous process industries of analytical or synthetical nature, rather than in the assembling industries. They present one of the most perplexing problems in cost accounting. Main products and by-products are often called "joint products" to indicate that the production factors of an enterprise are jointly required in their manufacture. By-products are also called "secondary," "additional," "minor," or "residual" products.

Main products and by-products travel together through the shop up to a certain stage in the manufacturing processes, when a separation occurs. The difficulty in accounting for by-products lies in apportioning costs between the two classes of products up to the time the latter break off or are divorced from the former. Subsequent to the separation no great trouble is experienced in recording the costs of either type.

Three methods of accounting for by-products are discussed in the following pages—designated for want of better names—first, second, and third.

#### **First Method of By-Product Accounting**

The first method—the common method—of by-product accounting is to record only the sales and return sales of by-products. For these two classes of information one account or several accounts may be kept, depending on the variety of by-products sold and the extent to which the management

wants to go in obtaining data for analysis. The difference between sales and returned sales, that is, the net sales, is closed into the "Other Income" or "Miscellaneous Income" section and not into the "Manufacturing" section of the profit and loss statement.

### **Objections to First Method**

Several objections are raised against this method:

1. The accounts do not reveal the separate costs of the main products and the by-products. As a matter of fact, no attempt is made to calculate or even estimate the manufacturing costs of by-products. These costs are buried in the accounts which show the manufacturing costs of the main products.
2. The selling and administrative expenses necessary to dispose of the by-products and main products are not segregated.
3. In the absence alike of the manufacturing and the selling and administrative costs, it is absolutely impossible to separate the losses or profits on by-products.

In consequence of these deficiencies, the costs are not known, selling prices cannot be fixed intelligently, and manufacturing policies cannot be based on facts. Nevertheless, it may be the only practicable method for many plants, particularly small ones, where the separation of the costs of the main products from the costs of the by-products involves too much clerical work, or where no clearly defined basis of separation appears.

### **Second Method of By-Product Accounting**

The second method of accounting for by-products is similar to the first except for the following feature: The ex-



penses incurred in making by-products salable after they have been split off from the main product and the expenses of selling them, are either debited directly against by-product sales accounts or entered in separate preparation and selling expense accounts. Neither of these two methods of by-product accounting shows the manufacturing costs of the by-products prior to the time they separate from the main products. The only advantage of the second method over the first method, therefore, is that it records certain expenses—selling and marketing—which are applicable to by-products.

### **Objections to First and Second Methods**

Two very marked objections to both the first and second methods of by-product accounting in certain cases are that in the first place no physical inventories of by-products are taken; in the second place no stock record sheets are kept for by-products. This failure to observe two fundamentals of cost accounting precludes the possibility of even approximating by-product costs. Still another objection is that entries for by-products are not recorded when they are produced, but only when they are sold. Hence a true cost history of by-products does not exist.

The facts noted above show that these methods are conducive to loose and faulty accounting and the perpetration of fraud. Since adequate records for by-products are often not maintained, not only workers but also executives have sold by-products and have appropriated the proceeds for their own personal use.

Furthermore, with inadequate accounting, no reductions in the manufacturing costs of main products are shown by the records. Yet, as a matter of fact, the manufacture and sale of by-products does decrease the costs of the main products, and from a strictly honest standpoint should be so regarded in figuring the cost of the main product.

### **Third Method of By-Product Accounting**

The chief point of the third method of accounting for by-products, which is in marked contrast with the first two methods, is that the costs of the main products and by-products are kept in separate accounts. The same feature applies also to the sales. This third method has many variations but this principle runs through them all.

The third method of accounting for by-products is as follows: Arbitrary values are assigned to by-products when separated from main products. It will be remembered that under the first two methods the costs of the main products and by-products were combined. Such combination defies analysis. In probably the majority of cases it is impossible to calculate precisely the costs of by-products. Even under the third method, arbitrary values must often be assigned to by-products.

As a rule, these values are regarded as only the material costs of by-products. They may be regarded as the manufacturing costs, however, if the by-products require no further manufacturing treatment before sale. This material cost is not regarded as the final cost of the by-products unless they are purchased in the shipping-rooms of the factory. In that case, obviously no selling and marketing charges are incurred.

Before adopting the third method, however, two chief factors should be considered, namely: (1) the amount of accuracy possible, consistent with logic and without hair-splitting over detailed costs; and (2) the value of by-products, particularly, as compared with the value of main products.

### **Calculating Material Costs of By-Products**

Where the third method of by-product accounting is used, the material costs of by-products may be ascertained, with varying precision, in several ways:

1. The material cost can be accurately calculated if the firm can buy the material for the main products and by-prod-

ucts separately—supposing it so desires. If the manufacturer of the by-product does not buy the material, its cost in the plant may be regarded as the difference between the selling price and the approximate profit.

2. Arbitrary values can be assigned to residuals—by-products—extracted from the main products, if the extracted residuals have a market value. Any part of a profit that might have been made if the residual were manufactured independently and not extracted, is not included in the cost of the residual.

3. The arbitrary values used, instead of being market values, may be those which are apportioned between the main products and by-products when the two classes of products are capable of comparison by a common standard such as the number of British thermal units. Such a comparison may be made, for instance, in plants which carbonize coal in order to get coke, the gas obtained being regarded as a by-product; or in factories where gas is the main product and coke is the by-product. Since the values of both products in these two cases are large, serious attempts should be made to approximate the values of each class of product in order to be able to fix proper selling prices.

4. If the value of material in by-products cannot be closely determined by any one of the three methods described above, it can be estimated by the procedure known as “working backwards.” In order to understand this method, refer to the following figuring sheet.

The material, labor, and burden costs up to the time the by-product splits off from the main product are first recorded. Then the value of the by-product at the time it is divorced from the main product is calculated. This value is deducted from the cost of the main product up to the splitting off point, in order to ascertain the net cost of the main product. The subsequent costs of both the main products and the by-prod-

ucts can then be readily calculated in order to arrive at final and unit costs.

**Cost of Main Product up to Splitting Off Point:**

Material .....	\$10,000.00	
Labor .....	8,000.00	
Burden .....	6,000.00	\$24,000.00

Less Value of By-Product per By-Product Statement shown below .....		4,220.00
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Net Cost of Main Product.....	\$19,780.00	
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**Subsequent Cost of Main Product:**

Value at split off point.....	\$19,780.00	
-------------------------------	-------------	--

Material .....	\$1,000.00	
Labor .....	1,200.00	
Burden .....	800.00	3,000.00

Final Cost of Main Product.....	\$22,780.00	
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Unit Cost of Main Product (300 units).....	\$ 75.93	
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**Cost of By-Products:**

Selling Price .....	\$ 6,000.00	
---------------------	-------------	--

Profit 10% of Selling Price.....	\$ 600.00	
----------------------------------	-----------	--

Administrative and Selling Expenses 3% of Selling Price .....	180.00	780.00
---	--------	--------

	\$ 5,220.00	
--	-------------	--

Less Material, Labor, and Burden Cost from time of split off .....	1,000.00	
--	----------	--

Value at time of split off to be credited to cost of main product .....	\$ 4,220.00	
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**Subsequent Cost of By-Product:**

Value at split off point .....	\$ 4,220.00	
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Material .....	\$ 400.00	
----------------	-----------	--

Labor .....	500.00	
-------------	--------	--

Burden .....	100.00	1,000.00
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Final Cost of By-Product.....	\$ 5,220.00	
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Unit Cost of By-Product (100 units).....	\$ 52.20	
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**Superiority of Third Method**

The following are some of the objections to the third method of accounting for by-products:

1. In some cases it is impracticable because of the clerical work involved.
2. Some manufacturers take the attitude that the costs of the main product are not affected by the costs of the by-products.
3. Some manufacturers are reluctant to show on their books any decreases in the manufacturing costs of main products owing to production of by-products. They fear that the dissemination of costs through financial statements made public may lead customers to demand lower prices for main products.

Notwithstanding these objections to the third method, they are in most cases untenable because the third method involves the calculation of separate costs of by-products and main products which is not done under the first and second methods.

As manufacturers come to realize the need of more accurate costs, they will adopt the third method.

## CHAPTER XXVI

### DEFECTIVE WORK LOSSES

#### **The Ever-Present Result of Carelessness**

One serious drain upon profits is defective work. The losses which result therefrom are largely due to carelessness, although not always owing to carelessness for which someone can be held directly responsible.

Theoretically, if all materials were absolutely perfect, if they were handled in exactly the way they should be, and if all work in connection with them was done in exactly the manner it should be done, the results would be perfect. In actual experience, however, the transformation of any combination of raw materials into a finished product is never so perfect but that some defects are to be found.

Castings, for example, will have blowholes and other defects, and even though not detected at the foundry, these defects seriously affect the working of the metal in the machines during the machining operations. Sand dug from the ground may seem to be in as perfect condition as is thought possible, and yet when used in the mould in the foundry, it develops that the best conditions of venting are not present, and the castings blow as a result of gas pressure. As the condition of the material worked upon has a large bearing on the result of the operation, losses sustained from such imperfections of material are naturally not chargeable to the operator performing that particular operation, because the condition of the material worked on is entirely beyond his control.

On the other hand, in probably the majority of cases, defective work is largely due to carelessness of some kind on the part of the operator. Particularly is this so when wrong cuts

are made, and when the completed work does not agree with the blue-print.

And yet again, far too often verbal directions are given by foremen. In the majority of cases when this is done, it is unfair to hold the worker responsible for mistakes in the machining. In such cases the responsibility for the defective work rests entirely with the management.

### **Inspection**

Cost records have brought out the industrial importance of maintaining in any manufacturing plant an adequate system of inspection. One of the first results of such a system is the detection of laxity in supplying workers with proper blue-prints, or with proper tools to work with. Inspection is also important in that it leads to the study of the means of correcting errors which are being made. Moreover, inspection enables the management to anticipate the possibility of defective work through the experience gained in going over what has been done and in learning from what quarters errors may be expected and the reasons therefor.

It is not enough to wait until material has been completed and is ready for shipment, but inspection must start almost at the initial operation in order that all succeeding operations may be safeguarded. Intermittent checks during the various processes will prevent the work from going wrong in the first place, with the result that the final inspection becomes more a matter of routine than of finding anything defective.

### **Methods of Guarding Against Defective Work**

Wherever possible—and it is possible with regard to the majority of manufactured products—gauges and other instruments should be provided for trying out the work, not only as an aid to the inspection department, but also for the use of the operators. It is not safe to assume that an oper-

ator at some high-speed point of production will rely on measurement, unless the measurement is made by a fixed instrument and no judgment or brainwork is involved.

In this connection too much stress cannot be laid on the operating results which should follow the exhibits of cost figures, particularly in fortifying all workers and inspectors with proper instruments for minimizing erroneous sizes, and thus preventing defective work.

### **Various Kinds of Defective Work Losses**

Defective work losses may be grouped, in the main, as follows:

1. Cost of labor and overhead required to salvage defective work.
2. Loss of the unused part of salvaged material.
3. Labor and burden entirely lost when material has to be scrapped.
4. Loss of the difference between original and scrap value of material.
5. Loss of profit due to extra time taken on machines in salvaging material when other new material should have been produced for sale.
6. Loss of profit on material which has to be scrapped.

The last two items, it is true, are never computed in the cost records; nevertheless the loss occurs, as other material could have been made and sold at a profit, if the machines had not been engaged with salvaged material.

### **Judgment to be Used in Connection with Salvaging**

In many industries, more labor is put into salvaging material than is warranted by the loss which would be incurred if the material were scrapped in the first place. Particularly is this the fact in the metal industries of all kinds since the



developing of the expensive art of electric and oxy-acetylene welding. This comment applies, it is true, more to the salvaging of new material, than to the welding of older material which when accidentally broken frequently affords possibilities of large saving.

But in the production of new material, particularly in operations which are highly specialized, great care must be taken to determine closely the dividing line between a profitable salvaging operation and one whose cost would amount to more than if the piece were entirely scrapped. This problem is a difficult one to solve in the steel-casting industry, where it has become possible to fill in defective spots by means of up-to-date welding apparatus. As welding, however, is so expensive, even though the work turned out is of a wonderful nature, it becomes a question as to how much of it can be profitably done.

Another feature in connection with this or any other salvaging operation is the fact that the possibility of saving the material eases up to a considerable extent the conscience of those responsible for the operations in the first place, with the result that increased carelessness is apt to occur. This tendency can be checked by penalizing either the department or the original operators who produce the defective work with the cost of salvaging the work. It is admitted, however, that inasmuch as costs cannot be determined without difficulty, perhaps this method cannot be carried out in many places.

In any event, a great deal of study should be given to the question of salvaging, in order that decisions regarding it may be based on economy rather than on simply the idea of saving a particular piece of material, regardless of costs.

### **Charges for Defective Losses**

As intimated in the previous section, it is always a good plan to charge the department responsible for defective work,

either with the cost of salvaging the work or with the losses incurred if the material is scrapped.

If in a rubber plant, for example, the milled compound furnished to the calenders or the tube department is defective, it seems just and fair that the milling department should stand the cost of the losses incurred by the department using the defective material. The management of the department producing this material should most certainly have a continual reminder of the results of the defective work turned out by such department. And in a cost system where all such details are accounted for, every department should stand not only its own cost for defective work, but also that a portion of the cost of any other departments occasioned by errors which it has made.

As the excellence of cost-keeping increases, more and more attention is paid to matters of this nature in order that the real efficiency of each operating department may be known.

### **Analysis of Causes of Defective Work**

One of the most important steps in connection with the handling of defective work losses is that of analyzing and correcting the causes of the defective work. A sample of such analysis is shown in Form 41—a foundry scrap report used in a grey iron foundry. It will be noted that this report gives a true history of each day's pouring, both as to the number of castings poured and as to the causes of defective work.

This form is shown simply to illustrate the use of analytical statements of defective work. Some form of this nature can be applied in connection with almost every manufacturing operation. In textile industries, for instance, it is easy to prepare a form upon which reasons for defective work may be entered, and to have an analysis sheet showing all defects. A similar analysis as to defective work can be made in industries concerned with the manufacture of wood, rubber, metals—



indeed in almost any industry. It is, however, of little use to have analytical statements unless particular and careful use is made of them.

Statements of this nature show very clearly what might be called "epidemics" in a plant. It very often happens that a certain class of defects will sweep through a plant and require very stringent action to stop its course. If defects are standardized into a code and analyzed, the means of preventing these epidemics will be discovered.

#### **Use of Defective Loss Information in Cost Sheets**

With any method of costs in which a classified statement of defects is furnished with each run, it is advantageous to incorporate a statement of these defects in the cost sheet. The statement of defects will not always have an exact value attached to each item, but it will help to explain variation between runs of like material. In almost any industry, the cost of like material produced at different times varies to a considerable extent, and when the material is made on a piece-work basis, it is quite difficult to explain this variance unless some automatic means is provided for doing so.

If it were possible, the value of defective work might be taken from a production order cost and transferred to the burden accounts to which it belongs. As an actual fact, however, it often happens that the entire cost of an order is charged up, and divided by the number of good pieces produced. In all such cases it is of the utmost advantage to have the statement of defective pieces and the causes therefor appended to or made a part of the cost sheet.

#### **Defective Loss as Burden vs. Direct Cost**

There has been much argument as to whether or not the cost of defective work should be allowed to remain under a productive order number in a job order cost system, or

whether the value of the defective work should be credited to this order and charged in the burden.

If the job under consideration is such that there is little likelihood of its ever being done again, the position that the cost of defective work should be allowed to remain against this particular job is well taken, the argument being that some record should be made of the fact that the work is risky and dangerous and should not be accepted again without due consideration. Work of this nature frequently arises in jobbing factories, machine-shops, foundries, etc.

On the other hand, in a manufacturing plant where the run of work is continuous and where the matter of defective losses may be regulated with care, it is probably best to assemble all defective work in the departmental burden accounts of those responsible for the work, in order to spread the overhead throughout the business.

To back up the argument as to special orders, the foundry may again be taken as an example. An order is received for 2,000 castings which are very difficult to manufacture. The casting is heavily cored, is difficult to mould, and has thin sections adjoining heavy sections. The estimator appreciates the fact that it is a risky casting and the job is taken on the basis of an allowance for, say, 25% or 50% loss. The price, it should be remembered, is given after such a loss has been figured in the estimate. When the run is completed, however, it is found that the loss has amounted to nearly 75%, because of the heavy shrinkage and the heavy discount for cracks caused by the junction of the light and heavy sections.

In cases of this sort each individual run must be considered on its own merits, and most certainly the heavy loss from defective work in the instance cited should not be charged into any burden account to be considered in the figuring of the costs of castings where a normal loss of 5% or 6% would prevail. Beyond question, in any industrial plant which

is making a product on a special-order basis of this nature, no matter whether it is a foundry, woodworking plant, or any plant, the defective work in such cases should be allowed to remain as a cost against the particular order, and not spread in any general overhead.

On the other hand, in plants where regular work of repeat nature is the rule and a close study can be made of all defective losses, and where such defective losses are more often the result of causes which have nothing whatever to do with the nature of the material, it would seem more fair and equitable to concentrate such losses as are incurred in the burden accounts of the departments which caused the loss.

This applies particularly, as stated above, in those industries where such losses are occasioned more by changes in personnel, by carelessness, and by the various other causes which are linked up with plant conditions, than with any special features in connection with the work which is being produced.

## CHAPTER XXVII

### THE INSTALLATION OF A COST SYSTEM

#### **The General Problem**

The installation of a cost system in any industry whatever is a problem, the extent of which is little realized, but which at the same time is comparatively easy if approached in the right way. Satisfactory installation can be accomplished only after a most careful survey of all conditions, and after a careful planning out of all the steps which are necessary to bring about the best results. While, however, these steps naturally differ in different places, the fundamental principles underlying the whole are practically the same.

Success is largely a question of personnel, meaning by this that, as with any other undertaking of magnitude, it is necessary to have everyone understand fully the intent of what is proceeding, and to be lined up to render whole-hearted and conscientious assistance.

The matter of installing a cost system is no single-handed affair. It may be that some one brain may direct and co-ordinate the movements, and may outline the steps which are to be taken. But, unless everyone in the organization is in full sympathy and aids in every possible way, there is very little hope of ever attaining the desired result. It therefore is best to prepare the way by straightforward propaganda as to exactly the meaning of the movement to install the methods of keeping costs.

#### **Initial Propaganda**

The initial propaganda should convince everyone in the organization that a cost system is designed to assist and con-

struct, rather than to criticize and destroy. Everyone should be convinced that no move should be made without there being the means to reflect the results of the moves in figures, for the personal efficiency of each department head and subordinate is crippled unless these persons are supplied with the means of knowing what accomplishment they make from month to month in the conduct of the duties with which they are charged.

It therefore is of the greatest importance to accomplish this through well-planned propaganda. To line up in this way every man in the organization on the side of the desire for costs is of the utmost importance, and if properly managed is easy. Once it is done, the installation of the cost methods will become a matter of simply carrying out details and overcoming what physical obstacles may be encountered from step to step.

### **Fundamental Foundation Work**

It is useless to expect to build up a system of costs without obeying certain laws as to fundamentals. The detail of these fundamentals will not be discussed in this chapter, but reference will be made to other chapters as the discussion of the work of installation of a cost system progresses.

In Chapter III the matter of establishing the basis of cost was discussed. In Chapter VI the matter of departmentalization was discussed. These two chapters have an all-important bearing on the problems of installing a cost system; without the strictest attention to what is there brought out, a cost system will invariably fall down, as it *must* have the most effective and complete foundation.

It therefore is necessary to decide on the proper departmentalization of the business along the lines indicated in Chapter VI. This departmentalization is designed to carry out responsibilities and to take into consideration the location of



departments, both from a physical and a cost-keeping standpoint, and the nature of operations.

The next step is the matter of establishing the basis of cost. This means not only the basis for the productive costs, but also the establishment of every possible basis of finding a unit cost for purposes of comparison in regulating the indirect or service departments of the company.

### **Establishing Controls**

When the matter of departmentalization and the basis of cost has been disposed of, the task of starting the work in the plant must be faced.

It is useless to attempt to keep costs in any institution whatever unless there is an absolute control of all contributing factors which have to be considered in the costs. This means that there must be :

1. Material control—all material must be in stockrooms under the control not only of stock-keepers but also of stock records.
2. Labor control—there must be a competent timekeeping staff backed up with clocks for verifying the “in” and “out” movements of employees to safeguard the pay-rolls.
3. Accounts control—there must be established on the general ledger of the company a comprehensive set of control accounts to set up a backing for the cost records. This also means that the books of account must be so designed as to take care of the control accounts in the ledger.

A detailed discussion of the above three points follows :

#### **1. Material Control**

*Product Control.* There are a number of things entering into the matter of material control which are of the utmost

importance. The first is that of the control of the product as relates to the specification of parts which are manufactured. These specifications should be in full detail and should show first all the products as sold to the trade. The specifications should show all assembled parts and all the individual and minor assembled parts which enter into the full assembly. Likewise the minor assemblies should have their own lists of individual parts which enter into their construction.

There should be on record the proper raw materials necessary to produce the individual parts, which will be used as a standard by the cost department to check the charges for material made against the orders of producing departments. The above specification should be prepared in regular form with copies in the cost department, the stock record department, and the operating departments. It is almost useless to expect ever to obtain actual costs unless there is an accurately established list to work by in assembling the figures when they come from the shop.

*Physical Control.* With the knowledge of what is to be made, the next step is to be absolutely certain that the materials are under control from the time they are issued on requisition. This means that all materials must be safely stowed away in stockrooms under the care of a competent stock-keeper. That should be the practice in any up-to-date manufacturing institution, whether operating a full set of costs or not. It is folly to have materials strewn around the plant in every kind of place; such conditions invite waste, spoilage, and pilfering.

To expect to figure costs with any degree of accuracy without having the material under proper stockroom control, is out of the question. The first real step is to make sure that all material is under such physical control that every movement in and out is safeguarded so far as can be, in order to provide the proper records of consumption of material with which to figure the costs.

## 2. Labor Control

The control of labor is somewhat along the same lines as the physical control of material. Unless the management can have an absolute knowledge of the basic time spent by all employees in the plant, followed up by a detailed knowledge of just what they did while in the plant, it is useless to expect any costs. It is therefore necessary to provide "in" and "out" clocks—as described in Chapter XV—to establish by the employees' own records the length of time that is spent at work. These methods are generally known and need no discussion here.

The next step, however, is of greater importance, as accurate accounting for the time spent by each employee in the plant involves a large amount of detail.

In the past it has been more or less the custom to have employees keep their own time, handing in their conception of what they have been doing. This is most unsatisfactory and unsafe, as well as actually expensive, as compared to the method of having timekeepers to attend to all this detail. In any plant it will be found that the time spent by workers in making out their time cards will amount to at least 15 minutes per day. These workers should be producing goods instead of making out time cards. It is plain economy to have this work performed by timekeepers thoroughly trained in the requirements.

As a general rule one timekeeper should take care of 100 workers. The economy which is effected appears from the fact that this would represent on an average of 1,500 minutes of workers' time. As the average time worked on shifts is now coming to be eight hours, the time used by the one timekeeper, looking after about 100 workers, is only 480 minutes, as against 1,500 minutes when time is kept by workers.

In addition to this, the timekeeper knows exactly what to do and makes out the time cards in a legible and orderly way.

If workers keep their own time, it is necessary to instruct each of the 100 persons as to what to do, and moreover, the majority of the cards received from workers are so illegible that the errors alone cost more to correct than the timekeeping would cost in the first place.

Finally, the timekeeper can also be of immense assistance to the foremen in each operating department. This feature alone justifies the employment of timekeepers under any cost method.

It is therefore urged that anyone installing a new cost system have no hesitation about using timekeepers instead of having the time cards turned in by the workers.

### 3. Accounts Control

There is little use in attempting to operate a complete control of costs without the backing of a comprehensive set of control accounts in the general ledger. One of the worst features of past attempts in cost work has been the attempt to figure costs on the basis merely of memos, without having an absolute check on each step and without tying up the costs with the general books. The full machinery of controlling costs, whereby the cost records are brought through to the final conclusion of the monthly profit and loss account, is not so complicated as many people believe. The operation is that of natural sequence, and the careful recapitulating of the various steps into the necessary journal entries take but little extra work. The value of the check on every step of the work is far beyond the cost involved in the work necessary to maintain the check.

Briefly sketching the main steps involved in cost-keeping may be of value at this point. It must be remembered that this description is very brief, and does not attempt to cover each individual item by any means.

First of all, we have the original books of entry, which consist—speaking roughly—of the voucher register, wherein

the entire load of initial distributon should be concentrated, the cash disbursements book, the cash receipts book, the sales register, and the general journal.

### **Nature of Control Accounts**

Control accounts consist in reality of only two classes:

1. *Asset and Liability Accounts.* These accounts include such accounts for assets as the cash and bank accounts, accounts receivable, material, and work in process inventory accounts, plant investment accounts, miscellaneous investments, prepaid items, etc. For liabilities there are such accounts as the bills and vouchers payable, accrued wages, reserves, bonds and mortgages, capital stock, etc. Accounts of this class have balances at the end of each month. That enables a balance sheet to be prepared, which in itself is a complete statement and which serves as a check on the Profit and Loss account.

2. *Profit and Loss Accounts.* In the old days of accounting there was but one account called Profit and Loss. To this was charged all merchandise used, labor, expense, etc. As the need of analysis developed, this account has come to be known as the account which represents the results of many analytical accounts known by special names.

This chapter will therefore deal with the analytical accounts, although it must be remembered that all accounts other than those used in the balance sheet are in reality divisions of the Profit and Loss account.

(a) *Sales Accounts.* Whereas by old methods the sales were credited to the Merchandise account, it is now necessary to have many different sales accounts. This is for the purpose of analyzing the sales of a company to show in the records the results of the various branches of a business.

In order to analyze these sales properly, it is necessary to have a companion account called "Cost of Sales" account,

to which is charged the manufacturing cost of the goods sold at standard rates of burden. Another companion account for each sales account should be the "Freight Out on Sales," which represents the cost of delivering the goods in case such sales are delivered to the purchaser.

(b) *Expense Accounts.* An expense account must be set up for each expense as decided on in the plant. This would mean a set of accounts for such items as Trucking, Cost Department, Pay-Roll Department, Electric Power, etc., as discussed in other chapters.

The control accounts for all this class of expense are used simply as collecting accounts to which are charged through the cost journal entries the various items of labor, materials, etc., the total of which is charged out immediately to the operating burden accounts. The final trial balance would therefore not show any balance against these accounts, as they are charged and credited almost simultaneously.

(c) *Burden Accounts and Burden Credit Accounts.* As has been explained in other chapters, there will be a burden account for each operating department, and a companion account to hold the credits of the burden actually applied in the costs.

These accounts will show an accumulated balance for an entire year, being closed out only at the end of a year into the Profit and Loss account.

### The Flow of Control

The arguments to be used in establishing the foregoing accounts may now be briefly described.

The initial purchases flow either into the inventory accounts, the pay-roll accounts, or various expense accounts.

Through the medium of requisitions and time cards, the items of material and labor flow out of the inventory and pay-roll accounts, and are charged to the expense accounts,

or to the work in process accounts—which are themselves inventory accounts but of a different class from the ordinary stock material accounts.

The various expense accounts as figured for the month are closed into the burden accounts.

The Burden Credit accounts receive credit for the burden applied at the standard rate, which is charged to the Work in Process Burden accounts. This brings the bulk of the burden into the line of inventory, coupling up with the Work in Process Material and Work in Process Labor accounts.

The orders which are completed are credited to these three work in process accounts and debited to cost of sales direct, or to finished stock accounts, in the case of material which is to be held for future sale. This leaves a true balance in the work in process accounts which may be used in the balance sheet.

In making out the profit and loss, therefore, there are the sales accounts together with their manufacturing and delivery cost; there are the balances of unabsorbed burden which are carried to Profit and Loss; there are the administrative and selling expenses; and finally the profit or loss for the month is determined.

### Installing Control Accounts

It is clear that there must be installed a comprehensive set of control accounts in order to have the check which is necessary to insure accuracy of all figures presented. There will usually be more or less opposition to the installing of what is considered so large a number of control accounts in the general ledger, but this opposition must be overcome if the costs are to be assembled in a safe and dependable manner. Therefore, the one installing the cost work should *insist* that the control accounts be established, as without them there will be a constant danger of inaccuracies which might result in very

disastrous decisions affecting the policies of the company, an inevitable result of *unproved* costs.

### **Subsidiary Factory Ledger**

It may be well to mention at this point that in many cases there has been installed a subsidiary factory ledger in order to obviate the necessity of having the detailed control accounts in the general ledger.

While this is allowable and perfectly possible of accomplishment, it has always seemed a quite unnecessary procedure, and one involving extra work. To maintain a subsidiary factory ledger means that there must be in the general ledger a number of main control accounts to give a trial balance which is worth anything at all. This means that all the moves in connection with the factory ledger must be regulated in accordance with the controls which are maintained in the general ledger, all of which largely entails extra work.

The usual objection to having the basis of all the control accounts in the general ledger is the inability of the accountant controlling the general ledger to understand the moves in connection with the factory accounts. As a result of this, every conceivable objection is brought up to the maintenance of the control account in the general ledger. Three courses are open to the one installing a cost system, namely: to install the subsidiary ledger, to educate the bookkeeper, or to get a new bookkeeper who can understand what is wanted and how to carry it out.

It is recommended by all means to have all the control accounts in one ledger whenever possible. That is the cleanest and surest way to reach the desired results.

### **In General Regarding Installation**

As a final word in connection with the installing of a cost system, the fact may be brought out again that the greatest



care *must* be taken to have the foundation solid, particularly with reference to all the points which have been brought out in this chapter, and most especially in connection with the initial propaganda preparing the way.

It is most deplorable to know of cases where action has been taken by industrial institutions on supposedly accurate cost figures which turned out in reality to be mere wild estimates. The life of an industrial institution depends on actual and trustworthy figures which reflect the operations performed. It is therefore not too much to say that any failure to safeguard these figures is plain industrial folly.

Compromises and lines of least resistance have no places in dealing with matters of such importance as the figures of cost and profit and loss. A building erected on other than solid foundations is short-lived and dangerous. It is, however, no more dangerous than is a cost system built on other than trustworthy foundations. The parallel between the two is close. A building on an insecure foundation might stand for a time and might fool whoever was involved with its construction. But when abnormal times arrive, the strain is too great and the structure will tumble.

This is exactly the case with costs, and too much insistence cannot be placed on the importance of preparing the solid foundations on which to build the structure of records on which so much depends.

## CHAPTER XXVIII

### TOOL RECORDS

#### **Function of Toolroom Department**

The function of the toolroom department is to supply workmen with the tools, appliances, and fixtures best suited to their individual needs. This equipment should be kept in excellent condition by proper grinding and shaping, otherwise work will consume more than the allotted time, and inferior workmanship will result. Moreover, slow or faulty production is invariably reflected in reduced sales orders.

Because tools are cash in another form, they should not be scattered promiscuously throughout the plant; those not in use should be stored in a toolroom kept under lock and key.

#### **Organization of Toolroom Department**

The toolroom should be under the jurisdiction of a tool supervisor, whose duty it is to issue tools only upon receipt of an authorized requisition or tool check. He inspects tools upon their return, and issues instructions for their repair.

A modern plant has a tool design department, a toolroom, and a tool crib. The latter is simply a storage place; the first designs, and the second makes most of the tools used. Other tools are manufactured in the blacksmith shop or are purchased.

#### **Classifying and Symbolizing Tools**

A plant requires a variety of tools. Some are durable and hence serviceable for work on many jobs; some are valuable only as scrap after they are used on a single job. Others, though durable, are intended for a special purpose only. The

life of tools and the use to which they are to be put, therefore, conditions their accounting treatment.

Symbols and classification facilitate the accounting for tools. Tools should be classified according to the purposes for which they are to be used. On each tool and its receptacle is etched, engraved, or stamped a symbol. Tool lists, tool orders, and tool requisitions and tool checks carry the symbol. The classification of tools adopted is listed in a tool classification book.

The tool classification book may take the form of loose-leaf sheets or blue-print sheets. The first sheet is an index which shows a general classification of tools. The subsequent sheets show the detailed classification. This book has two distinct advantages: it expedites the location of tools when symbols are forgotten but names and sizes are remembered, and it simplifies the symbolizing of a new tool not yet classified.

### **Small Tools**

Small tools—those not attached to machines or equipment—when bought or made are charged to tool inventory or stores accounts. When small tools are requisitioned, they are charged to subsidiary stores accounts or to maintenance expense accounts depending on their disposition. If tools are replaced when worn out, reserves for depreciation of tools need not be set up. Depreciation of used tools which are still serviceable is provided for by inventorying tools at a more or less arbitrary figure—say two-thirds of their original cost—at the start of a new cost period. Thereafter all replacements will be charged to expense, and any distinct additions to the equipment of tools will be charged to the tool inventory account at cost. Stock record sheets are kept in a subsidiary ledger for the detail entries affecting tools which are in stock.

### **Double Tool-Check System**

The best method of safeguarding tools is called the "double tool-check system." This system requires the use of two different kinds of checks—round and square—both of which should be made of some durable material, such as brass or aluminum. The round checks bearing the employee's pay-roll number can be exchanged for tools. Each employee is given a set of these checks for which he is held responsible. The square checks are stamped with the names, and sometimes with the sizes and numbers or symbols, of the various tools. For example, a check for a reamer may be stamped "9/16" reamer.

These square checks are hung on hooks in front of the drawer or compartment in which the tools are stored. In the toolroom there is a tool-check board about five feet square, provided with hooks over which each man's number is stamped. When a tool is issued to an employee, the square check is transferred to the tool-check board under the employee's number, and the workman's round check is hung on the hook in front of the drawer or compartment from which the tool is taken.

Under this system the tool-check board shows at any time the number and names of the tools each employee has out; and the round checks on the tool drawers or compartments show to whom the tools were issued. When the workman returns a tool, the square check is removed from the man's number and hung on the hook of the compartment to which the tool is returned. The employee's check hanging in front of the tool compartment is then returned to the employee. Thus a double check against each man's number for tools issued is always provided. Suppose an employee returns five of six tools charged against him. He should be notified at once of the outstanding tool still charged against him. Take the case of a man who has lost one of his checks, upon which some

other man has received a tool. When the loss is reported, a small red check is hung upon the tool-check board under the man's number. Suppose later the finder of the lost check attempts to use it in exchange for a tool. When the toolroom-keeper starts to hang the square check representing the tool on the board, the red check thereon reminds him that a check has been lost. Or suppose a tool has been issued on a lost check before the loss is known. The return of the tool later will lead to the detection of the loss when the toolroom-keeper starts to remove the square checks from the man's number and sees the red check.

Under a modification of this system, tools and checks are returned to the toolroom at the close of each day rather than at the time of completion of jobs which require tools. This system enables the toolroom-keeper to check daily the issuances of tools.<sup>1</sup>

Since each tool is accounted for by either a check or the tool itself, the keeping of a physical inventory of tools is simplified. The sum of the number of tools in the toolroom and the number of checks on pegs outside tool drawers should equal the number of tools that should be on hand. Such checking should be done daily so as to insure the detection of any differences.

### Denominational Checks

Denominational checks, which bear a series of numbers rather than a single number, are sometimes given to employees when a quantity of tools of the same size and symbol are issued to one employee. In such cases their use simplifies the procedure of issuing tools. Denominational checks are usually of a different size and shape from the "regular" checks.

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<sup>1</sup> This plan is used at the University of Illinois under a system worked out by G. H. Radebaugh and J. A. DeTurk. See their article, entitled "Tool Supply Room," in *Factory Magazine*, December, 1916.

### **Tool List**

Tools are not always issued to individual workmen personally. Instead they are issued upon presentation of a tool list. A tool list is prepared by the planning department (when one exists) for each job in advance of operations. The list shows the number of the job, the machine number, the class or symbol of tools, and the number needed for the job. The list is sent to the toolroom. The required tools are placed in a tool-box and taken by a messenger to the workman who is to use them. This procedure conserves the productive time of workers and prevents many delays due to lack of tools.

### **Single Tool-Check System**

The double tool-check system has supplanted the single tool-check system in modern plants. Yet from a historical viewpoint the latter system is interesting. It worked as follows: Each employee was presented with a set of checks stamped with his pay-roll or time-clock number. The check, presented to the toolroom-keeper by the workman who desired a tool, was hung on a hook outside the receptacle from which the desired tool had been taken. Although tools were issued to employees only against their checks, the system afforded no means of ascertaining the exact number of tools in the possession of each workman. This information could only be obtained by taking a physical inventory. The single tool-check system, therefore, did not furnish a proper control of tools.

## CHAPTER XXIX

### ADVANTAGES OF STOCK RECORDS

#### **Stock Records an Aid to Entire Business**

The stock record is the keystone of the material cost records. It aids especially the purchasing, storeroom, production, and cost departments. With a knowledge of requirements, orders, balances on hand, past consumption, minimum and maximum quantities, purchasing can be carried on intelligently. With stock records the storekeeper can properly account for materials, parts, etc., under his supervision. Production can be controlled, through a knowledge of requirements, orders, and balances on hand, etc. Material costs can be controlled if stock records are maintained, because such records provide the means of showing quantities and values requisitioned for individual orders, etc. Furthermore, they show balances on hand which can be compared with physical inventories.

The advantages of stock records cannot be fully appreciated until after a knowledge of the technique of stock record accounting has been gained. The advantages set forth in the following pages, therefore, should be studied in conjunction with the main sections of the modern stock record sheet discussed in Chapter X.

#### **Savings Effected by Proper Ordering**

If purchases are kept within the maximum and minimum limits recorded on stock record sheets, too much capital is not tied up in stock, with the accompanying excessive storage, interest, and insurance charges. Nor do delays in production ensue because of lack of materials. Close and persistent examination of purchase orders, purchases, deliveries, requisi-

tions, and stock balances, together with a careful graphical study of price movements of material, is of inestimable service in preventing these unfortunate and expensive conditions.

The amount of material to be ordered when the balance of stock approaches the minimum is known as the "quantity to order." The "quantity to order" is taking the place of the "maximum quantity" in many factories. The figures in the "Year," "Quantity," and "Time Required to Get" sections of the heading of the stock record sheets aid greatly in calculating the minimum, maximum, and quantity to order. Knowledge of the time required to get materials after placing an order also aids the production control department in scheduling the work of the operating departments.

### **Production Aided by Listing Requirements**

If the plant has detailed specifications of the product which show the material and parts necessary for its manufacture, the stock record clerk can intelligently fill out the "Requirements" columns. Unfortunately, however, relatively few concerns have exact specifications regarding their product, operations, and machines. Without them neither proper planning nor accurate accounting for costs is possible. Lack of proper specifications is one of the most frequent reasons for the failure of cost systems. With a knowledge of the material requirements for parts and products, however, necessary materials, etc., can be provided in advance of actual needs, and thus production is facilitated.

### **Deliveries Facilitated by Appropriation of Stock**

If materials and parts are appropriated for production orders according to their priority, the product can be made and delivered to customers on time, provided no unforeseen delays occur. The production departments, therefore, are vitally interested in appropriations. The purchasing depart-



ment, unlike the production departments, is not interested in the appropriation of stock, since its chief function is to order the proper material to supply requirements.

### **Steady Production Aided by Prompt Ordering and Urging**

Not only must the quantities of material ordered be sufficient, but deliveries from vendors must be kept ahead of consumption needs. It often becomes necessary for the buyer to send an urger or inquiry to the seller. Prompt urging is indeed as important as prompt ordering. It should be done in a spirit which recognizes that tardy deliveries are often due to forces beyond the control of the shipper. The need for urging may arise from the inability of the seller to ship according to schedule; or from the fact that the buyer consumes material quicker than he anticipated because of wasteful use of stores or the filling of rush orders. Nevertheless, if material is not received on time, production will slacken or stop. Lack of sufficient supplies causes manufacturing losses which, although often unnoticed or ignored, are probably greater than any other losses with respect to stores. A slowing-up or stoppage in operations prevents the filling of orders according to contract. That results in cancellation of orders, and that in turn increases unit manufacturing costs, since the overhead has to be apportioned over reduced sales.

### **Savings by Keeping Deliveries Within Contract Limits**

Stock records facilitate checking receipts of stock against purchase orders, special contracts, etc. Material may be specially contracted for, long before delivery. If prices rise during the delivery period, vendors may be tempted to charge the buyer the new market price before all deliveries have been made on the old contract, trusting to the buyer's forgetting that the old contract has not been completely filled. On the other hand, if the market price has fallen prior to the comple-

tion of deliveries on special contracts, the vendor may try to overrun contract requirements, trusting that the buyer will continue to pay the former market price. When a concern is purchasing regularly from a given firm, it is especially possible for such malpractice to occur. The way to prevent it is to scrutinize very carefully special contracts and the deliveries applicable thereto, as shown by the stock records.

### **Detection of Improper Accounting for Receipts**

By means of stock records, amounts received are recorded for all classes of stock. This facilitates the detection of improper accounting for receipts. Dishonest receiving clerks, in collusion with drivers of delivery wagons, sometimes receipt drivers' bills but permit some drivers to keep and sell certain material, later on dividing with them the proceeds from the sale. The purchaser, in the belief that he has received all material ordered, settles for invoices in full. Such misappropriation has been discovered when stock records have been checked periodically with physical inventories.

### **Consumption Records of Material Aid Economical Buying**

Stock record sheets show requisitions of each class of stock and also indicate the destination of material, whether to job numbers, contract numbers, departments, etc. Such consumption data are serviceable to the management in estimating future requirements of stock and facilitating economical ordering.

### **Elimination of Wasteful "Help-Yourselfes" Methods**

Furthermore, a system of stock records eliminates the wastes from promiscuous access to stock. If everybody has free access to stock which is not under lock and key, the natural result is that foremen and workers, because of self-interest and departmental interest, accumulate reserves of stock near

their work places. That causes an inequitable distribution of stock throughout the plant and hinders efficient production. Such departments will have material in excess of requirements; other departments will not have enough.

Stock records provide the medium for discovering abnormal consumption of stores due to such "help-yourselves" methods. For example, a certain plant was located on the bank of a river. Its workers had for years been throwing spoiled product into the river. As workmen could procure stock at will, unusual consumption of material had never been detected. During a drought the river almost dried up and the large quantities of spoilage were discovered. The discovery so astounded the management that it installed a perpetual inventory immediately. A stock record reduces spoilage, scrap, and waste losses because it registers unusual consumption, and because it makes for orderliness, always the foe of waste.

### **Bidding on Contracts Expedited**

With respect to material costs, the going inventory expedites bidding on contracts. Several years ago two concerns—A and B—received a request to bid on a contract. The former kept stock records as a part of its accurate cost system; the latter did not have a good cost system. Within a few hours after the receipt of the offer to bid, A was able to quote a price on the contract because it estimated the costs thereof by reference to past costs—consumption of material, etc. On the other hand, the manager of the B concern had his office force scurrying excitedly around the plant, picking up piecemeal costs here and there. Several days elapsed before B could estimate his costs and furnish a bid. Because of superior information which expedited prompt bidding, A landed the contract. Concerns of the A type usually secure the lion's share of business, particularly on rush orders. The stock record, therefore, is a valuable adjunct to the estimating department.

**Ready Knowledge of Balances on Hand**

As mentioned before, the running total columns of a modern stock record sheet eliminate the need of a balance on hand column. The balances on hand, however, can be quickly determined by subtracting requisitions from receipts. With a knowledge of the quantity and cost of materials, etc., on hand, the designing department can intelligently design new work called for by production orders. Purchasing and production, likewise, are materially benefited by information of available balances of parts, materials, supplies, sub-assemblies, etc.

**Fire Loss Adjusted Equitably**

One of the most important advantages of the perpetual inventory is that it facilitates an equitable settlement with insurance adjusters in case of fire loss. Adjusters naturally try to keep settlement amounts as low as is consistent with good business policy. But some adjusters have opinions with respect to stock records that are difficult to understand. A certain adjuster, for example, who is supposed to be an eminent authority on loss adjustments, contends that a stock record is not advantageous in settling fire losses. He admits that insurance adjusters after a fire are under the necessity of receiving an inventory prepared by an appraisal company for what it may be worth, just as they would receive any other evidence submitted for their consideration; and furthermore, that the inventories prepared by such a company are in excellent form and in very minute detail, prepared very conscientiously, and as near correct as it is possible to make them, since the property owner desires exact truth with respect to his property both for loss and for coinsurance purposes. He urges, however, that as values are subject to fluctuation—it has been violent in the past four years—an inventory made one year may not be of much value the next year. This adjuster, looking at the

matter of the value of stock records through company glasses clouded with company bias, fails to get the manufacturer's viewpoint.

Accountants do not agree with all the views of this authority. They contend particularly that in any event a stock record makes possible a more equitable settlement than could otherwise be had, since comparisons between past perpetual inventories and past physical inventories can be made. If the comparisons disclose substantial agreement between these two classes of inventories, the adjuster should be willing to consider the book inventory at the time of the fire loss as indicative of the physical inventory burned up. To be sure, the book inventory carried at cost prices may not represent market prices at the time of the fire loss. Even so, book records are indispensable evidence of losses in respect to quantities and values. In fact, book inventories are usually more correct than physical inventories. This view is not enough appreciated. A professor of cost accounting was addressing a Lumber Dealers' Association on the value of stock records in time of fire loss. Many of his hearers kept no stock records. During the address one of the manufacturers present received a telegram saying that his lumber yard had been completely destroyed by fire. The telegram was made known to the audience. The dramatic incident lent vivid color to the weight of the professor's statements.

### **Reduction of Obsolete Stock**

Since the stock record shows the dates on which supplies were received, the age thereof can be determined. If the storekeeper keeps in close touch with the market, he can ascertain whether or not his old stock is obsolete or obsolescent. Such stock should be disposed of in some way, because it is more or less of a dead loss. Accumulations of "shop-worn" stock decrease the stores turnover, which in turn decreases the profits.

### **Compilation of Monthly Financial Statements**

When stores records are maintained, financial statements can be compiled frequently—every month if desired—without the necessity of taking a physical inventory in the different storerooms and departments. It is true that the values of the book and physical inventories may not be the same, but the former are more likely to be correct. As a result, the financial statements prepared monthly upon the basis of book inventories are very accurate. A monthly physical inventory of all the stock is not practicable because of the labor entailed and the time lost in production due to the partial or whole shut-down of the concern.

### **Advantages of Stock Record Sheet Illustrated**

Special points in connection with the modern stock record sheet as shown in Chapter X, Form 14, may be mentioned as follows:

1. Running totals
2. Requirements and ordered
3. Appropriated
4. Received
5. Issued

#### **1. Running Total Columns**

By many tests made during the actual operation of stock records, it has been proved that the number of times a balance is actually used is very small in comparison with the number of times it was computed. It has also been proved that an enormous amount of extra work is involved in the use of the balance method in answering questions of the purchasing, production, sales, and other departments with reference to the quantities used in given periods.

The reason for this extra work has been the necessity of adding the full detail of the entries for the period desired.

By the use of the running total method, figures desired can be quickly obtained through subtraction. For example, the balance on hand can be quickly determined by simply subtracting the total requisitions in the running total column from the total receipts in the running total column. Furthermore, the running total method increases the accuracy of the stock records because it involves mostly addition and little subtraction. Balances of materials on hand, determined by the balance method, disclose only a net result. Balances arrived at by the running total method not only disclose that information but also enable questions as to quantity to date for any period to be instantly answered.

Stock record clerks should watch every item of material, noting the length of time it has been in stock, how quickly it moves, etc. Whether or not stock records are a constant and useful source of cost data, depends largely upon the stock record clerks.

## **2. Requirements and Ordered Columns**

Because of the close relation between the required columns and the ordered columns of the stock record, they are here discussed together.

The recapitulation of the requirements of material parts, etc., needed for the product that is to be manufactured is entered in the requirements columns. This information is obtained from schedules, shipping orders, and breakdowns of assemblies. The requirements are compared with the quantities ordered, as shown in the ordered columns, in order to ascertain whether or not requirements are being covered by either production or purchase orders—production orders in the case of manufactured parts, purchase orders if material and parts are bought.

In some cases only the actual or net requirements are entered. In other cases the minimum of material to be carried

is recorded and added to the net requirements. This obviates an error which might otherwise arise through mentally adding the minimums to the requirements.

When the minimum is entered in the requirements columns, total of the ordered columns must always equal the total of the requirements columns. If this practice is not followed, however, the minimum must always be mentally added to the total in the requirements columns so that the quantity required can be compared with the quantity ordered.

### **3. Appropriated Columns**

The quantity of material which it has been decided to use for machine schedules, assemblies, and shipments, is entered in the appropriated or reserve columns. Thus production control and the scheduling of shipments are facilitated. The appropriated columns are arranged in such a way that a running total of the appropriations on each order, as well as the grand running total of appropriations on all orders, may be kept.

### **4. Received Columns**

There is little to be said about the received column, for the data entered in it are self-explanatory. As orders are received in full, the entries in the ordered columns should be checked off. In this way the management can ascertain whether the quantities which have been ordered to cover requirements have been received.

The amount column must be filled out because the invoice cost and transportation charges of material are often entered separately. The unit price, which includes both the invoice cost and the transportation charges, is then recorded.

### **5. Issued Columns**

It has been found of little value to have the stock record clerk stop to extend the amount in the issued amount column,



or to make the entry after the extension has been made by a comptometer operator. In fact, on some stock record sheets the issued amount column has been omitted.

It is sufficient to enter the price, as that affords enough information to enable all of the material received at one price to be properly cleared when entries are being made for requisitions.

#### **Relation Between Columns of a Stock Record Sheet**

In general, the relation between the different columns of stock record sheets may be summarized as follows:

1. "Requirements" less "Appropriations" equals the balance of materials or parts, etc., not scheduled.
2. "Requirements" less "Ordered" indicates whether requirements are covered.
3. "Requirements" less "Received" shows how far behind the plant is in getting material and parts needed for requirements, either from the outside or from manufacture.
4. "Requirements" less "Issued" shows requirements not issued from stock.
5. "Appropriated" must never be greater than "Received."
6. "Appropriated" less "Issued" equals balance of appropriated material not issued.
7. "Ordered" minus "Received" equals amount due on orders, either purchase or production.
8. "Ordered" must exceed "Requirements" by the amount of the minimum.
9. "Received" less "Issued" equals balance on hand.

#### **Advantage of Carrying Money Values on Stock Records**

Money values of all purchased raw materials, purchased supply material, all individual parts, sub or minor assemblies,

and full assemblies—where the product is manufactured in standardized and segregated lots—should appear on stock records. There are a number of reasons for this procedure.

1. It is the only way to price out correctly material used. (See Chapter XII.) The safest and easiest method of pricing out material is by actual lots. It gives inventory balances that are correct and enables correct financial statements to be compiled. In cases where material is bought on more than one contract and is consumed in large quantities, it may be priced at average cost.

2. It saves clerical work. The stock record clerk should price each requisition, passing it on to the comptometer operator for extension, and then it should be forwarded to the cost department. If values were not carried on stock records, it would be necessary to enter the quantity of each requisition on the stock records, to send it to some other clerk for pricing, and then to still another for computing and cost work.

Furthermore, pricing should be done by the stock record clerk, since the stock record is the *only* record showing when each lot of material is exhausted. To prove this, consider the case of a price book kept in the purchasing department containing, for example, the following data:

March	1,	500	pieces,	\$2.00	each.....	\$1,000.00
"	25,	1,000	"	2.25	" .....	2,250.00
June	15,	2,000	"	2.35	" .....	4,700.00

These were spot purchases made at different prices. The material is used in odd quantities, some of it being consumed as late as July and August. In this case what price should the purchasing department use—\$2, \$2.25, or \$2.35? If the purchasing department cannot price material in such a way as to allow accurate detailed costs to be kept, neither will the controlling accounts for material and supplies be accurate. If, on the other hand, the stock record clerk prices requisitions,

the items thereon can be easily identified, thereby insuring accurate pricing.

To have pricing done by some department other than the stock record department is not desirable. Requisitions are not in shape for proper accounting of the material consumed. (See Chapters XI and XII.) On the other hand, each stock record sheet kept for each class of material shows the name or number of the controlling account for that material. The stock record clerk marks the controlling account number or name on each requisition before it is entered on an accumulation sheet and then filed in the cost department. Thus proper credits can be made to material control accounts.

An ideal perpetual inventory system involves a constant and systematic checking of items in order that the plant will not have to shut down for inventory. A cycle of checking for each control account should be completed at least once a year. When the cycle is completed and the individual stock record sheets show that each item has been verified, the dates on which the balances of the different accounts are to be struck are selected.

The balance of each item must always be priced properly. This means that if the balance is larger than the last lot in and the previous lot price is different from the last, the balance will be priced at the last lot price to the extent of the lot, and the rest of the balance will be priced at the previous cost.

## CHAPTER XXX

### UNDER- AND OVER-ABSORBED BURDENS

#### Past Treatment

In the first stages of cost accounting attention was confined practically to the direct-material and direct-labor cost. To these two items, constituting prime cost, was added a blanket percentage to cover the overhead. Up to twenty years ago this method was widely prevalent, and even today some industrial plants are still struggling along with costs compiled in this way. In those early years no one had any real knowledge of the meaning of overhead, or any conception of its enormous importance from an economical standpoint. In fact, overhead was for many years regarded as a great mystery—a sort of secret word which would emanate once every twelve months, after a secret conclave behind closed doors in the treasurer's office.

Even today, it is repeatedly found that while men have had experience in keeping direct labor and material costs, as to the overhead they have merely applied percentages handed down to them by the appointed powers of the business, who had the sole hand in setting such percentages.

As time went on and competition developed, it came to be recognized that the very elusive indirect expenses of a manufacturing plant constituted a factor which had to be taken into careful consideration. Then came the development of "cards of accounts," a device which was really along the right lines. It was intended to give an analysis of the indirect cost which, if properly kept, would prove of some value.

Still later, when it became recognized that any general percentage of overhead was erroneous and that a finer dis-

tion was necessary in order to arrive at a cost which would more closely represent the true conditions, the indirect expenses were divided up into segregated accounts and extended into the various departments of the business.

It is now recognized that there are hardly any two departments in a manufacturing institution which should operate under the same rate of burden. This, therefore, has brought us to the stage of departmental rate of burden—the most modern and accurate method known.

### **Annual Burden Rates**

Nevertheless, even though it is now acknowledged that departmental burden rates are necessary, only a small minority of manufacturing institutions assemble their actual burdens oftener than once a year. While manufacturing plants are quite fairly analyzing the various items which make up the burdens, they allow this tabulation to cover the space of an entire year, keeping the same purely from an accounting standpoint. Their sole purpose is to determine a new rate for each department to be used during the following year.

There has been a general failure to realize that the figuring of actual burden every month has a value far and above that of purely an accounting function, namely, that of establishing a control of all the indirect expenses as they are incurred. In other words, from a managerial standpoint, the old method of compiling annual figures is absolutely valueless. It is much to be regretted that a greater percentage of manufacturers have not come to realize the managerial advantages of having monthly statements of the various burdens in place of the annual statement.

### **Monthly Statements of Actual Burdens**

It has been distinctly proved that a very close rein can be kept on the indirect costs of a manufacturing plant by

the compilation of monthly burden statements, on the assumption that these burdens are computed on carefully prepared monthly orders, usually called "standing orders."

These orders are so prepared that the various groups, which make up the indirect costs, are clearly defined in a manner to be definitely usable. This particularly applies to the expense accounts which represent service activities—Electric Power, Trucking, etc.—and which are at the close of each month distributed to the various departmental burden accounts and combined with the indirect costs which are charged directly to the departmental codes. In this way, live and accurate statements of the various items which make up each departmental burden can be assembled and presented each month.

By comparative statements, the executive organization is thereby placed in a position to handle these costs as a regular managerial function, and cannot fail to effect reductions if the proper study and research is made.

### **Necessity for Standard Rates**

On the other hand, actual burden which is entered in the burden statements cannot be used in costing current work in process or in estimating selling prices, because actual burden is not known until the end of each month. Product must be costed and selling prices fixed during the month—indeed, selling prices are often set long before the product is made. Accordingly, in calculating the burden to be applied to current work in process, predetermined rates are used, generally based on the average monthly figures for the past year. These rates are called "standard."

Moreover, burdens should be based on normal conditions, taking into consideration not merely the average of burdens but also the normal productive capacity of the plant. Every manufacturing institution has its high and low marks of production. As a result, with respect to normal burdens, a period

of high production will furnish such a large figure as a basis for distributing the burdens that the rate per direct-hour or direct-labor cost decreases to a considerable extent. On the other hand, periods of depression will produce a very high rate per direct-labor hour or per direct-labor cost.

If such extreme rates are used, disaster is certain when the product is sold. Work taken on the basis of the low burden rate caused by abnormally high production will result in enormous losses if produced by the plant during normal or low productive times. Work figured on the basis of the high burden rates caused by low production will never be secured, because of the high prices which would naturally be asked.

Unfortunately, many manufacturing institutions attempt to price their estimates of selling prices and to assemble their actual costs on the basis of the actual burdens for the month in which the work is estimated on or performed—or at least for no more than the last two or three months' average. This method cannot be used in any plant or group of plants with any safety whatever. Even those plants which manufacture a steady stream of product throughout the year are subject to variations as between summer and winter, which precludes any possibility of using burden figures in this manner.

The matter of repairs to equipment would alone furnish sufficient argument to disprove the notion that any collection of figures covering a short period can be safely used. The greater amount of all necessary repairs for an entire year may be concentrated, by chance, in any one or two months during the year. This is particularly true in all lines of industry in which heating furnaces are used—foundries, forges, rolling mills, and the like.

An attempt to do business on the basis of actual burdens is thus fair neither to the producer nor buyer. The only fair basis is to figure all estimates and applied costs with a pre-determined rate of burden for each department, basing this

rate on an average of monthly figures for a period sufficiently long to indicate how actual burdens have been running.

### **Standard Rates—Duration**

Departmental burden rates should be adjusted on such a standard basis—or what might be termed a long average basis—covering a sufficient time to represent properly the indirect cost of the plant in a level figure which is used in estimating and cost figuring.

The standard burden rate, predetermined in this way, is used for a certain period or cycle of the business—a period sufficiently long to embrace all seasonable features. In the usual manufacturing plant this cycle is one year. The reason is that one year in a seasonable business would cover the busy and the dull seasons, as well as the winter and summer. This period, therefore, has come to be quite generally regarded as the proper cycle on which to adjust a standard rate of burden.

In some lines of work, indeed, it is necessary to allow for expenses which come in a cycle of from two to five years. An illustration of this might be cited in certain rolling mill operations in which heating furnaces are expected to operate anywhere from two to five years. It is necessary to take into consideration, when adjusting the rate of a department which employs equipment of this nature, the amount of money involved in the major repairs or rebuilding which must be done in the long periods and which must be prorated throughout the time intervening. Such long periods are an exception, however, and as a general rule a cycle of one year will cover the great bulk of both major and minor repairs.

### **Control of Burdens**

After standard burden rates have been determined, the next natural step is to provide the means of controlling the actual burden of each operating department through depart-



mental burden statements, as a result of which the greatest profit may be obtained from the figuring of costs.

There is entered on each burden statement the burden applied to productive orders at the standard rate for the department concerned.

If in a particular month the product is running low, the natural result is a balance in the burden account for each department which is not absorbed into the actual costs by the use of the standard rate. On the other hand, if the month should happen to be one of high production, there is entered in the burden account an amount of burden applied to actual costs in excess of the actual burden expended during the month. As a result the actual burden accounts become, in a sense, *reserve* accounts; in good months the actual burden is overabsorbed by the standard burden, and in the lean months this overabsorption is reduced by the underabsorbed burden which remains on account of the lack of product going through. Theoretically, if the business runs as expected, operating burden accounts should balance at the close of the fiscal period. In other words, there would be in such cases no under- or over-absorbed burdens.

### Older Theories—Machine-Rate Control

The effort to handle in greater detail the indirect costs of a business and to distribute them more carefully among the productive orders, led some years ago to the devising of more or less detailed methods, in some cases much overdetailed.

The machine rate method of distribution offers an example. This method has many merits, but on the whole it must be admitted to have been abused, particularly in view of the enormous detail to which it has led. It is essential, of course, to apply certain costs on the basis of machine hours (see Chapter XXXII). But the attempt to dispose of the entire body of indirect costs in that way, by means of voluminous distribu-

tions on the basis of floor space and other considerations, has proved altogether too elaborate and expensive to use. Moreover, it has proved too inaccurate.

In developing these machine rates, the problem of disposing of the unused machine time and its value led to many discussions. The problem was especially acute with those systems in which almost the entire overhead was supposed to be distributed through the medium of the machine hour. To dispose of the unused time which inevitably occurs was bound to be a serious matter, with any system which attempted to figure the costs on the basis of 100% of maximum time, rather than on the basis of normal productive capacity—say, from 80% to 90%.

Under the old theories the entire cost of burden, or the entire cost as expressed in machine rates, was used—or rather the attempt was made to use it—in figuring the cost of product. These theories have been long ago proved to be ruinous to a business. To use the actual cost of the overhead during dull times is almost certain to prohibit the securing of any new business. To include the many hours lost through idle equipment when the machine rate was used, or the entire burden when the plant was running at, say, 50% capacity is an absolute impossibility. Even if it were not an impossibility, it would be an absolute injustice to the purchasers of goods to expect them to pay for expenses which in no sense could be considered in proportion to the value of the goods purchased.

### **Church's Theory of Accounting for Idle Machines**

The unfairness of the old doctrine with respect to idle machines and equipment was modified somewhat by A. H. Church in his books on "The Proper Distribution of Expense Burden" and "Production Factors." He said, in substance, that idle time overhead should be charged to manufacturing

costs through the medium of a supplementary rate, in conjunction with the use of the fixed machine rate for normal or standard manufacturing overhead; and that the supplementary rate served as a sort of barometer of factory efficiency. He believed, therefore, that an increase in the supplementary rate disproportionate to the increase in the fixed machine rate indicated a decrease in factory efficiency, and vice versa.

The chief merit of Church's theory was that it focused attention on idle machine and equipment costs, which had formerly not been shown in separate accounts. But his theory, according to some good cost accountants, is erroneous, in that it led to charging the costs of idle machines to manufacturing costs in cases in which the factory management was not responsible for machines being idle. Such charging made it extremely difficult to compare normal costs which were not separated from unusual costs, for the costs of idle machines were included along with the normal overhead in the manufacturing costs. This combination, by uniting two independent variables, made comparison of overhead costs and total manufacturing costs practically worthless. Costs appeared high when production slackened, and low when it increased. As the production pendulum swung back and forth during busy and dull seasons, the cost records failed to provide an accurate basis for proper management.

The deficiency of cost records under this method was particularly felt when costs were at their highest and lowest points. The system failed the manufacturer entirely when most sorely needed. Suppose a manufacturer's costs appeared high by the method of accounting under discussion. He might increase his selling price, but that would decrease his orders and put tighter brakes on his production; instead of solving his problem, he accentuated it, this being the only possible result from the method used.

Nor did the trouble end here. In periods of curtailed production, both under the old method and under Church's method of accounting for the costs of idle machines, unit costs increased because the fixed overhead continued and was distributed over a lesser number of units. Such a condition frequently influenced manufacturers to buy a product for resale when the purchase price was seemingly lower than the price for which they could manufacture and sell it. Furthermore, the firm's costs for all products under the erroneous treatment of the costs of idle machines might be greater than the selling prices of its competitors. If the above policy were not a good one for a single product, how could it be a good one for all products? If carried to its logical conclusion, it would result in a factory changing from a manufacturing to a buying concern.

If manufacturers realized that not all the cost of idle machines is a manufacturing cost, that a portion is a general charge against the profits, and that the factory should not be regarded as a "cost samaritan," so to speak, for the selling and administrative department or the burden as a whole, they would make a suitable provision for the cost of idle machines and would not formulate illogical policies. As a matter of fact, intelligent policies are more needed by some firms than funds.

### **Modern Theory—Under- and Over-Absorbed Burdens**

The fact that outside business conditions have a vital bearing on the running hours of machinery and equipment received little attention up to within comparatively recent times. When, however, the fallacy and limitation of Church's theory became apparent, a new theory for the handling of under- and over-absorbed burden was practiced by C. H. Scovell in the spring of 1911 and was stated in an address before the National Association of Machine Tool Builders on October

22, 1913.<sup>1</sup> This theory is that "only a part of the total burden is chargeable to the manufacturing cost of the product made during periods of curtailed production, the part chargeable being the same percentage of the total burden, as the curtailed production is of the standard production."

For example, suppose the normal production is 10,000 units, and the normal factory overhead is \$5,000. A bad season occurs and the production falls to 5,000 units, or 50% below normal; the burden chargeable to the 5,000 units would be 50% of \$5,000, or \$2,500. The rest of the burden might be charged direct to the Profit and Loss account. This theory has been ably supported by the late H. S. Gantt and others. The theory was stated by Mr. Gantt in a paper entitled "The Relation between Production and Costs" presented at the spring meeting of the American Society of Mechanical Engineers, June, 1915, although presaged in a paper entitled "Measuring Efficiency," delivered at the annual meeting of the same society in December, 1914. According to Walter N. Polakov, formerly associated with Mr. Gantt, the theory was practiced by the Gantt Company as early as 1908. A necessary feature for carrying out the theory is to decide just what is normal or standard production. A definition of standard production, however, has already been given.

The modern theory of accounting for over- and under-absorbed burdens was in use even earlier. The idea of standard burden, with the over- and under-absorbed balances carried monthly to the profit and loss statement, was a principle used as early as 1906 by William J. Gunnell, certified public accountant, of Buffalo, New York, and J. P. Jordan, then associated with him.

The statement on page 400 shows the form of the actual statement now in Mr. Jordan's files, of the machine shop of the Waterous Engine Works Company, of Brantford, On-

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<sup>1</sup> See C. H. Scovell, "Cost Accounting and Burden Application," page 71, footnote 2.

tario, for the month of June, 1907, at the bottom of which are shown the comparative figures of the actual burdens back to and including November, 1906.

It is interesting, moreover, to note that two years later, C. E. Knoeppel, who at the time knew nothing of Mr. Jordan or Mr. Gunnell, installed almost identically the same method in the plant of the Struthers Wells Company, of Warren, Pennsylvania. The Loss and Gain account of this company reproduced on page 401 shows the unabsorbed burden carried to the Loss and Gain account, after the burden has been credited with the amount applied to actual costs at standard rates.

As evidencing the great improvement which has been made in the presentation of cost records, it is instructive to note that both of these statements, while illustrating the point in question as to the use of standard rates and the carrying to Profit and Loss of the under- and over-absorbed balances, are from the point of view of modern practice somewhat crude, and of course no longer to be used as patterns. Reference should be made to Chapter XXI for the present structure of burden statements.

### **The Future of Cost Accounting**

The developments outlined in this chapter represent the results of a consistent demand, on the part of those responsible for the manufacturing operations, for actual and usable figures to act as a guide.

This demand compelled the preparation of statements of indirect costs so grouped as to make tangible what had previously been regarded as intangible. In this the influence of the engineer has contributed increasingly.

In the future of cost accounting the close co-operation of the accountant and the engineer will unquestionably lead to improvements and refinements as notable and far-reaching as those related in this chapter.

**WATEROUS ENGINE WORKS COMPANY**  
**BURDEN ACCOUNT—MAIN SHOP—JUNE 30, 1907**

	To June 30, 1907	To May 31, 1907	Month of June, 1907
<b>Direct Manufacturing Expenses:</b>			
Changes Loss.....	\$ 000.00	\$ 000.00	\$ 0.00
Repairs and Replacements.....	0000.00	0000.00	000.00
Sundry Expense.....	0000.00	000.00	00.00
Painting Machinery.....	000.00	000.00	00.00
Burden Labor.....	00000.00	0000.00	0000.00
Labor Adjustment.....	000.00	000.00	00.00
Spoilage Loss.....	000.00	000.00	00.00
Power, Light, and Heat.....	0000.00	0000.00	000.00
Fuel (Forge).....	0000.00	0000.00	000.00
Insurance and Taxes.....	0000.00	0000.00	000.00
Insp. Lumber, and Machinery.....	000.00	000.00	
Bonus Labor.....	000.00	000.00	00.00
	<u>\$00000.00</u>	<u>\$00000.00</u>	<u>\$0000.00</u>
<b>Proportion of General Expenses:</b>			
Engineering Salaries.....80%	\$ 0000.00	\$ 0000.00	\$ 000.00
Engineering Supplies.....80%	000.00	000.00	0.00
Stable Expense.....80%	000.00	000.00	00.00
Factory Salaries.....80%	0000.00	0000.00	000.00
Storekeepers.....80%	000.00	000.00	00.00
Watchman.....80%	000.00	000.00	00.00
General Labor.....80%	0000.00	0000.00	000.00
General Repairs.....80%	000.00	000.00	00.00
Shipping.....80%	0000.00	0000.00	000.00
Receiving.....80%	000.00	000.00	00.00
Mfg. Sundry Expense.....80%	000.00	000.00	0.00
Cartage.....80%	00.00	00.00	
Car Demurrage.....80%	00.00	00.00	
Freight.....80%	000.00	000.00	0.00
Duty.....80%	000.00	00.00	0.00
	<u>\$00000.00</u>	<u>\$00000.00</u>	<u>\$0000.00</u>
<b>Credit:</b>			
70% on Productive Labor.....	\$00000.00	\$00000.00	\$0000.00
Overcharge credited to Profit and Loss.....	<u>\$ 0000.00</u>	<u>\$ 0000.00</u>	<u>\$ 000.00</u>

**PERCENTAGES OF BURDEN BY MONTHS**

Month	Percentage	Average to Date
November.....	72.73%	72.73%
December.....	69.58	71.22
January.....	62.43	67.95
February.....	68.68	68.13
March.....	64.63	67.41
April.....	69.88	67.69
May.....	66.81	67.56
June.....	62.39	66.92

STRUTHERS WELLS COMPANY  
LOSS AND GAIN ACCOUNT, APRIL, 1909

*Debits*

Boiler Shop Burden Profit and Loss .....	\$1,931.16
Machine Shop Burden Profit and Loss .....	2,127.02
Balance Gain for Mo. ....	2,797.97
	<hr/>
	\$6,856.15
	<hr/>

*Credits*

Former Profit and Loss .....	\$ 263.07
Boiler Shop Income Account .....	3,903.52

*Debits*

Oil Boiler Sales .....	\$ 304.92
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*Credits*

Mackay's Boiler Shop Sales .....	\$3,483.32
New York Boiler Shop Sales .....	76.64
Boiler Shop General .....	648.48
	<hr/>
	\$4,208.44

Machine Shop Income Account .....	2,111.72
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*Credits*

Crawford's G. E. Sales .....	\$1,134.95
G. E. Sales .....	664.18
Machine Shop General .....	86.60
New York Engine .....	2.68
Oil Engines .....	175.61
Pittsburgh G. E. ....	47.70
	<hr/>
	\$2,111.72

Foundry Income Account .....	557.84
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\$6,856.15



## CHAPTER XXXI

### REGULATION OF IDLE EQUIPMENT DELAYS

#### Delays of Equipment

The large investment in the machinery and equipment of an industrial plant necessitates getting the utmost use out of this equipment. Proper planning of production and regulation of plant activities so as to secure this result constitute one of the greatest problems in industrial management. A well-known firm of industrial engineers recently stated that the average efficiency of equipment which they have found in plants when beginning their services has been about 50 per cent. This seems a ridiculously small percentage, but careful investigation reveals a multitude of causes which result in equipment standing idle and thereby losing the profits which otherwise would be made. The concern quoted above makes the further statement that 80 per cent of the causes of idleness of equipment are the fault of the management. When the causes of idle equipment are analyzed, this also may be seen to be entirely possible.

Accountants and engineers have devised almost every conceivable kind of scheme to bring about a greater use of all the facilities of industrial plants. Many of these schemes, however, have failed to reach the root of the trouble *at the time the trouble is occurring*.

They have generally relied upon weekly and monthly reports of the use of equipment—reducing the value of delays to a money basis—and upon elaborate statements prepared therefrom of the money lost in idle equipment. The money loss has then been carried into the burden accounts, thereby loading these accounts with the results of inefficient manage-

ment, to the point sometimes of producing costs which would absolutely prohibit the securing of new work on account of high prices.

Practically every plan of reducing idle equipment to a money basis resolves itself into a post mortem proposition which does absolutely no good.

### **Treating Causes of Delays at the Source**

The principal objective to be secured in connection with delays in the use of equipment is to stop the delays. This seems a simple statement, but it means a great deal. If action is taken at the time delays occur, most of the causes of delay can be readily corrected.

This discussion concerns particularly what is known as "standard equipment," that class of equipment which would be busy all the time, provided the plant management kept the operating departments fully supplied with proper materials, operators, tools, etc. The so-called single-purpose machines are in a class by themselves. With those the problem is one of the sales departments keeping the plant supplied with the particular kind of orders required to keep the special equipment going full speed. It is true that there is another class of single-purpose machines whose operation even for only an hour or two per day makes them well worth the money they cost, because of their high speed and the great savings they effect. Such machines, however, as they are of a highly special nature and relatively very few, are hardly to be considered in the problem of idle time.

The chief question is how to deal with the causes of delays at the source. If a machine breaks down, the management should not have to wait till the end of the week to learn that the machine broke down and was idle for two days. The breakdown should be a matter of record 15 minutes after it happens, in order that all the facilities of the control de-

partment may be exerted to get the repairs made at the earliest possible moment, thereby reducing the idle time which would result if the repairs were allowed to drag.

### **Accounting for Idle Time**

As explained in Chapter XV, the dispatch clerks have the duty of recording not only the time spent by men on particular jobs, but also the time of idle equipment, using a special card somewhat resembling a time card. Such a card, applying particularly to machine-shops, is shown in Form 42. The card is of a different color from the time cards, preferably pink or red, in order that when displayed in the dispatch board it will indicate graphically the number of pieces of idle equipment covered by the dispatch board.

The entries are simple, consisting of only the department and machine number and the time idle. The rest of the information is recorded by simply inserting a cross showing the cause of idleness and also whether or not the piece of equipment is a regular or a single-purpose machine.

On the dispatch board a clip is provided for each working place, that is for each individual piece of machine equipment. At all times, at the clip representing each machine, there will be either a direct worker's card, indicating that the equipment is working, or a pink card, indicating that this piece of equipment is idle.

### **Action Required to Correct Causes of Delays**

The action required in connection with delays in the use of equipment may be considered under two heads:

1. Anticipative action to prevent the occurrence of delays.
2. Action to be taken while the delays exist.

Preventing delays is by far the more important task. On the thoroughness of such prevention depends the correction

HOLDEN MANUFACTURING CO. BOSTON, MASS.																								Worker's No.	
USE THIS CARD FOR REPORTING IDLE MACHINES																								Date	
DEPARTMENT		NO OPERATOR		NO POWER		Dept. No.		Machine No.		Full		Hours		1		2		3		4		5			
1		1		5		1		1		1		1		1		1		1		1		1			
2		2		6		2		2		2		2		2		2		2		2		2			
3		3		7		3		3		3		3		3		3		3		3		3			
4		4		8		4		4		4		4		4		4		4		4		4			
5		5		9		5		5		5		5		5		5		5		5		5			
6		6		0		6		6		6		6		6		6		6		6		6			
7		7		1		7		7		7		7		7		7		7		7		7			
8		8		2		8		8		8		8		8		8		8		8		8			
9		9		3		9		9		9		9		9		9		9		9		9			

Form 42. Idle Machine Card. (Size, 7 $\frac{3}{4}$  x 3 $\frac{1}{4}$ .)

of most of the losses from idle equipment. It is the function of a production control department to watch and regulate all movements, and thus catch these dangerous and costly delays to equipment at their source. That method is far superior to any possible method of post mortem accounting for value of lost time, which various machine rate and departmental cost systems try so hard to provide. The old saying, "Locking the stable door after the horse is stolen," fits this situation closely. It is of little value to know how much the loss has been in comparison with the steps taken to prevent the loss before it occurred.

### **Causes of Idle Machines and Equipment**

The principal causes of idle machines and equipment, as indicated on the card shown in Form 42, are:

1. No operator.
2. No material.
3. No orders.
4. Machine breakdown or under repairs.
5. No power.
6. Awaiting set-up.
7. Waiting for tools.
8. Awaiting instructions.

#### **1. No Operator**

The responsibility for keeping up the supply of operators is primarily within the duties of the employment department. That department has the task of securing and distributing the working forces so that all pieces of equipment shall be kept going full speed, so far as the man power is concerned. It is essential, however, for the employment department to keep in very close touch with the operating foremen for two reasons: (1) to be sure that the operating foremen are using the employees in a way to keep them at work and not cause

them to quit or stay away from the job; and (2) to overcome the natural conditions of labor shortage which applies to some departments in greater measure than to others.

The production control department also has an important function in this connection. It was specified in Chapter XV that a late and absent report should be made up each morning. A copy of this report should be sent to the production control department, thus enabling that department immediately to ascertain what equipment is idle from the cause of no operator.

A check should be made at once of the schedules on the equipment which may appear to be idle from the cause of no operator, and no time should be lost in getting into communication with the employment department to learn what relief can be obtained there. If no men can be provided through this particular channel, the schedules throughout the shop or in this department and also other departments should be consulted to find some point where operators can be secured to man the idle equipment. In normal times, and even in abnormal times, a great deal can be accomplished in this way, preventing the loss of production which otherwise would result.

## **2. No Material**

Lack of material operates in many ways to delay the equipment, chiefly by—

1. Failure within the department to have the material for a job at the machine at the time the operator is ready to start.
2. Failure of the storeroom to fill a requisition in time to permit delivery to the machine when the material is needed.
3. Failure of the purchasing department to get necessary material to the stockroom to permit delivery at the time the job is ready to be started.

It is of extreme importance that material required for the performance of any operation shall be ready at the machine when the previous job is completed. Failure in this point results in many delays, all of which could be eliminated by the production control department.

Failure within the department to have the material on the spot when a job is to be started, is purely a breakdown in carrying out the internal transportation procedure which is under the full responsibility of the production control department. The dispatch clerks have entire jurisdiction over all movements of the material. As they know that a machine will need material for a job at a certain time, it is clearly their duty to see that such material is delivered to the machine in time. Delay from this cause, accordingly, is a delay which should never occur.

Failure of the storeroom to fill a requisition for the raw material or the parts required for an assembly order is in a similar way directly the fault of the production control department through the dispatch clerk. The movement of the raw material from the storeroom is also under the entire jurisdiction of the production control department. This delay also should never occur if the organized procedure is strictly carried out.

Failure of the purchasing department to get material into the plant in time for use is a different matter from the two preceding cases. Nevertheless, except for abnormal conditions, even this delay may be traced back to the stock record division of the production control department. If the data in connection with all the raw material have been adequately taken into consideration, if sufficient time has been allowed for the process of issuing the purchase orders, for making the shipment, and for the transit of the material, there should be no delays in connection with the receipt of purchased material.

The matter requires close co-operation between the purchasing department and the production control department, but in the last analysis the main responsibility lies with the production control department.

Of course, failure to receive raw material in time does not always result in idle equipment, as a change in schedule may be made which keeps the equipment running full. On the other hand, in specialized plants the results are often disastrous, particularly, for example, in automobile plants, where whole rows of regular machines are set aside purely for performing certain operations on particular pieces of material.

Another illustration may be found in any high-speed manufacturing industry—the manufacture of rubber tires, for example—where a slip in keeping enough cotton fabric ahead will cripple the entire flow of product and possibly shut down the entire plant. It must always be borne in mind that the function of the purchasing department is to purchase. It is the responsibility of the production control department, however, to see that material is purchased in sufficient time and in sufficient quantity. If this duty is carried out to the letter, the delays due to non-receipt of raw material can be avoided.

### 3. No Orders

Lack of orders may be owing to either of two reasons:

1. Failure of the plant order department to issue production orders in time to provide the work for the machines.
2. Failure of the sales department to supply the factory with sales orders which are necessary to keep certain kinds of equipment busy.

The first one should be entirely eliminated. It is a matter either of neglect or of overloading on the part of the department issuing the production orders. The production sched-



ules show clearly the work ahead and any failure to issue production orders considerably in advance of the time the work is required for the machines is a neglect which is practically inexcusable.

Yet that very thing happens in many cases, with results that are disastrous to perhaps more than one piece of equipment. The absolute removal of this cause for delay should be a matter of most strenuous action by some responsible executive.

Failure of the sales department to supply the factory with orders is a cause of delay which is subject to considerable debate. It should be said, however, that a production control department which is properly on the job can anticipate shortage of work, and thereby cause action to be taken by the sales department. Otherwise the sales department may know nothing of the fact that certain lines of work are running low.

A good illustration may be seen in a jobbing foundry where special jarring machines may have been installed to take care of work of various sizes. It may be that this particular foundry will do work ranging from small castings in snap flasks to castings weighing two or three tons, which can be made on the large jarring machine equipment which has been installed. The same thing is true of jobbing machine-shops or of any other kind of shop where there is liability of a shortage in various kinds of work.

The production control department, as the only department which has the information as to the exact tonnage ahead, has undeniably the duty of notifying the sales department of the shortage of orders for particular classes of work. If this function is properly performed, in the great majority of cases the sales department can easily secure the orders to keep all classes of equipment going at full speed.

The second reason for delay from lack of sales orders applies most particularly to special or single-purpose machines.

It should be given most particular attention by the sales department. Very often the sales department is responsible for installing such machines, agreeing to keep them busy if the investment is made.

#### **4. Machine Breakdown or Under Repairs**

The breakdown of machines, which occasions a large percentage of the lost time in the use of equipment, can be reduced to a minimum by proper management. A very effective means is the installation of anticipative inspection, applying the principle of a "Stitch in time saves nine." The fact is, with probably the majority of breakdowns, that if proper inspection of the machinery had been carried out, the weakness which finally resulted in the breakdown could have been eliminated before becoming a serious factor. Speedy attention should be given to each case of breakdown, to get the machine going at the earliest possible moment. This is a function of the control department, which should follow up the repair department actively and see that all possible speed is used in getting the machine back into production.

Many of the breakdowns occur through breaks of belting, a cause of delay which in nearly every case is absolutely inexcusable. Any mechanic can tell by the looks of a belt whether it is nearing the point of breakdown. A long delay may be easily avoided by having a new belt cut and put into place during the time the plant is not operating.

Inspection of motors should be made daily, particularly in plants where individual motor drives are used, and also when the group plan of drive is used, where the breakdown of a motor is a very serious consequence. It seems almost unnecessary to prescribe this action, but in many plants this inspection is not made and the resulting losses from idle equipment are very heavy. Care in cleaning motors saves many dollars in repairs.

Line shafting should be subject to constant inspection both as to its line-up and as to the matter of constant oiling and care. The pulleys on the line shaft are constantly loosening and need unremitting attention.

The more intricate the machine, the greater the necessity of constant inspection. This applies particularly to such machines as may be found in foundries, grinding departments, and other department where there is a great deal of dust and a liability to burn out bearings and tie up the machines in other ways.

A matter especially to be considered with regard to inspection is that very often, when a break occurs, the damage done is greatly in excess of what it would have been if the weak point itself had been repaired before the serious break took place. A broken belt has been known to fly through the air and land in the gears of another machine, causing another breakdown and a loss from broken equipment many times the value of the belt which caused the trouble. To this must be added the loss in production occasioned by the breakdown of both machines.

Constant surveillance by foremen prevents many breakdowns. Foremen can require material to be properly piled and small tools to be properly taken care of while lying on the various machine tools, and thus run no risk of causing expensive accidents. Foremen, assistant foremen, and inspectors can earn their salaries many times over by co-operating with machine inspectors in watching all conditions which have to do with causing breakdowns and tying up equipment.

When a machine does break down, the production control department should follow up the repair department to have repairs made and get the machine back into service as quickly as possible. In the case of a breakdown this work has to be done during working hours. All other repairs, however, the production control department should

have performed during the regular hours of shut-down rather than during the regular working hours so as to keep the equipment in operation.

### 5. No Power

Delays due to "no power" are usually caused by breakdowns in the power house in cases where power is generated within the plant. Lack of power may cause a stoppage of work in case of a breakdown or burning out of the motor driving either an individual machine or a group of machines. This cause of idle equipment can be obviated in the majority of cases by the anticipative inspection of electric motors.

In case of delays from this cause when the power is generated by the company itself, the power department must be followed up, so that the supply of power may be reinstated at the earliest possible moment. In the case of failure of power brought in from the outside, it is always necessary to ascertain at once from the distributing station the cause of the failure. It may be that the distributing station knows nothing about the failure of power until notified by the consumer.

### 6. Awaiting Set-Up

Delays from failure to have machines set up in time for jobs may arise from either :

1. Failure of the operating department to have a sufficient number of set-up men.
2. Failure of the production control department to schedule work so that the set-up of machines is well distributed, in order to avoid peak loads on the staff of set-up men which ordinarily is sufficient to handle the necessary work.

The first cause must be eliminated by the operating department itself, which should maintain a sufficient corps of set-up

men. As to the second cause, the control department must so plan the work that undue bunching of set-ups is avoided.

A well-organized production control department is fortified with the records of set-up time required for each and every job which is to be put into work. If a control board is used, this set-up time appears graphically, and therefore is easily noted. This department is also fully aware of the number of set-up men available in each department. It is entirely the fault of the production control department if a number of jobs which require the services of the set-up men are deliberately scheduled to start at the same time. Neglect of planning, indeed, is usually the largest factor in connection with the delays which occur on this account. Strenuous executive intervention is sometimes needed to overcome this cause.

#### 7. Waiting for Tools

Delay is caused very often by men having to wait for tools, usually because of the failure of the control department properly to plan and carry out the preliminaries in connection with each job to be performed.

It is a duty of the control department to safeguard against delays by seeing that all tools including jigs, etc., are ready ahead of the time for starting each job, and that they are delivered duly to the machine.

In the majority of manufacturing institutions the runs of work are sufficient to justify proper tooling. Even in a jobbing-shop where jigs may not be used, it was long ago demonstrated that the regular cutting tools should be ground in the toolroom and kept in readiness. In the production of many pieces of product it is absolutely necessary to have complete and intricate jigs.

The responsibility for supplying jigs rests between the operating department concerned and the production control department. The former must report any breakage or spoil-

age in tools being used on a job, in order that the latter may have the break repaired before the job is again scheduled.

Special tools damaged in the operating departments should not be returned to the toolroom until they are repaired. In foundries, patterns which are damaged during the progress of a job are often returned to the pattern vault without being put into proper shape for the next job. Patterns are often damaged while in storage. Hence, it is essential for the production control department to check up the tools, etc., sufficiently ahead of the requirements in order to be sure that everything is ready to start the work on jobs.

#### **8. Awaiting Instructions**

In some instances it is necessary to give the operator definite instructions in connection with the work to be performed. The instruction may consist of explaining blue-prints or making clear other details. It is definitely the duty of the operating foremen to be on hand to give the proper instructions at the time the material is delivered to the machine ready for the start of work. The dispatch clerk, moreover, representing the production control department, who is aware of the fact that instructions have to be issued, should make it his particular duty to give the foremen advance notice that this job is about to be started, thereby assuring attention to instructions and elimination of any delay.

#### **Idle Machine Report**

To aid in the careful watching and analysis of delays, an idle machine report is illustrated in Form 43. This form, it will be noted, gives a statement of the number of hours each individual piece of equipment is idle; the number of hours it should have run, based on the standard hours of the shop; the number of overtime hours run; and the per cent of the total idle time to the standard hours and also to the total hours



actually run, a valuable record from the managerial standpoint.

This report reflects every week the running conditions of the equipment and shows up both successes and failures of the effort to eliminate idle time of equipment. Perhaps, as a matter of record, the same report should be shown for a complete month.

The point needs to be reiterated that the *elimination* of the causes of idle time is of far greater value than merely holding post mortems.



## CHAPTER XXXII

### ADVANTAGES AND DISADVANTAGES OF DIFFERENT METHODS OF APPLYING BURDEN

#### Theories of Applying Burden

In this discussion, the distribution of such expense accounts as power, steam, etc., to *other* expense accounts and to the actual manufacturing burden accounts should not be confused with the actual application of the burdens to the cost of the articles actually manufactured for sale.

Moreover, this discussion naturally does not deal with costs which are in the nature of process or operation costs, but only with manufacturing burden which can be distributed to units under a job cost system only through the means of some basic vehicle, such as labor hours.

The original theories which underlie *all* methods of application of manufacturing burden to costs are quite clear. Theoretically, the proportion of supervision cost to be assumed by any unit varies according to the length of time the operator was supervised. The same theory holds true in regard to timekeeping costs. So also do the costs of rental and heat, and the cost of power used in driving the machine, enter into the cost of the unit in proportion to the time each of these factors is involved in its production.

The same may be said of the depreciation of all facilities, either building or equipment. Theoretically—and quite actually so in general—the *length of time* worked is the measure of the service necessary to keep the worker supplied with material and relieved of completed material, of keeping the working place clean, of oiling the shafting, and so on through

almost all the burden items which are necessary to keep the direct workers busy.

The *applied hour*, therefore, is without question the most theoretically accurate basis for the application of burden to costs. Of course, there are some items of burden, such as idle time or general labor, which cannot be reconciled to this or any other reasonable method of distribution. These items are few, however, and not of sufficient volume to amount to much in any event.

### Methods Actually Used

Actual practice in the application of manufacturing burden has developed more or less along the lines of least resistance. The three principal methods discussed in this chapter, with brief preliminary comments thereon, are as follows:

1. *Direct-Labor Hours Method.* This is without doubt the most accurate, especially when used in combination with a "super-rate" covering machine expense.

2. *Direct-Labor Cost Method.* This is a substitute for the direct-labor hours method. The value of the direct labor is used instead of the measure of time applied. It can probably be shown that in every case where this method is used it was adopted because it is cheaper to operate than the direct-labor hours method. The latter necessitates keeping an accurate account of applied time, which is not the case in a piece-work plant. Under the direct-labor cost method, however, the great advantage of knowing elapsed time for schedule and planning purposes is entirely lost.

3. *Machine-Rate Method.* When machines are a prominent factor in production, it naturally follows that it is necessary to take into consideration the time and costs of machine use. But to make the machine hour the basis of all kinds of charges is much overdone and useless, even to the point of being obscure and inaccurate.

### Advantages of Direct-Labor Hours Method

The basis of applying burden according to the direct-labor hours method is *time*—the number of direct-labor hours consumed in producing a certain quantity of one unit, in one operation. As stated above, this is beyond a doubt the most accurate method of applying burden. The attitude of the cost accountant toward accuracy depends to a large extent upon his reasons for distributing burden. If he looks upon the application of burden as a purely accounting necessity, he is not apt to be influenced largely by a desire for accuracy, and will probably use the most convenient method available. If, on the other hand, the cost records are to be used as a means of increasing production, accuracy is obviously one of the most important attributes of any method.

Supposing, for example, a plant runs under a piecework system, it is, of course, *easy* to use the method of applying burden on the basis of *value* of the applied work. But what becomes of the element of *time* as between fast and slow workers?

If costs are really to be cut down and *production* increased, the costs should always show the elapsed time for each and every operation. If this is done, and if the hours applied are kept, the results will convince anyone that the direct-labor hours method is of the greatest advantage, both from an accounting standpoint, and even more from a managerial standpoint.

The following is an illustration of an advantage of the use of the direct-labor hours basis for the application of burden. Two men on like work and using like equipment are working at the *same* base rate under a bonus plan. One man is a hustler and turns out 20% more work than his neighbor, receiving for this a bonus of 20% on his pay. This obviously indicates that the good worker works 20% less time than the other on the *same number of pieces*. Therefore, he uses 20%

less supervision, timekeeping, heat, light, etc., as all or the majority of burden items are directly in proportion to time.

By the direct-labor hours method, the burden is charged to the job in proportion to the time. If the direct-labor cost were used, the cost of the pieces made by the man who made the bonus would be flagrantly penalized by the burden on the *bonus earned*, while the slow man would carry less burden as he earned no bonus.

The great advantage of bonus methods is that *more* product is obtained from the *same* burden; therefore, unless the direct-labor hours method of burden application is used, the whole object of the bonus is defeated so far as the costs are concerned.

#### Disadvantages of Direct-Labor Hours Method

The disadvantages of the direct-labor hours plan are small when compared to its advantages. One of the disadvantages frequently mentioned is that the time, as well as the costs, of jobs must be calculated. This double calculation, so it is said, involves extra clerical work. But if workers are paid under a system other than the piece-rate system, the time spent by employees *must* be figured in detail in order to determine wages. Where piecework prevails, extra time for calculation is required, but after the great value of this knowledge is realized, the "disadvantage" disappears.

Another alleged disadvantage is the tendency of department heads and foremen to reduce the time required for the manufacture of work to an unreasonable degree. The contention with respect to this disadvantage is as follows: Inasmuch as the burden is proportioned to time, a saving in time will consequently reduce the overhead charged to orders. Hence, the time element may be overemphasized, with the result that the quality of product deteriorates unless it is carefully inspected, the wear and tear on equipment increases, and

the health of the workers may even be impaired. Department heads and foremen may ask for the purchase of time-saving and labor-saving machines without considering fully the increased capital and running costs of the machine which may offset the savings in time and labor. In other words, not enough attention is given in such cases to the operation of the economic principle of selection or substitution. This is all a fallacy, as the speeding up of work is the great goal of today; and under real control is, and will be, the great secret of success.

### **Advantages of Direct-Labor Cost Method**

Despite all the criticism and disadvantages of the direct-labor cost method, also termed "productive-labor cost method" and "percentage on wages method," it is still the most common method of applying manufacturing burden. Its popularity is due to simplicity and convenience.

A blanket rate for the whole factory, or rates for each department, may be computed. The latter method is the only accurate one. In either case the ratio of total burden (plant or department) to direct-labor cost (plant or department) is ascertained. The ratio is then applied to the direct-labor costs of individual units in order to determine the overhead chargeable to the units.

The direct-labor cost plan has other advantages. When labor charges are about equal in amount for each worker and the amount produced by each worker is about the same, the plan may be fairly satisfactory. Such uniformity occurs if goods are manufactured in large quantities—"mass" production—and are uniform in character. This uniformity is present where process methods of production are used. Hence, each unit of output requires about the same amount of labor time and labor cost in the technical processes. Because of these uniform conditions, either direct-labor cost or direct-

labor hours will prove a satisfactory basis for applying overhead.

On the other hand, though uniform conditions may prevail in a single department, they seldom exist throughout an entire factory. The direct-labor cost method, therefore, is of limited use. Rarely is it the best method for a whole plant.

About all that may be really said as to the real advantages of the direct-labor cost method of applying burden is that in plants where piece rates prevail, and when in such instances the elapsed time on jobs is not an absolute necessity to get the direct-labor cost, a small saving in clerical expense is made by its use.

But if the reader will carefully study the arguments for the direct-labor hours method and the need for some recognition of machine rates, it is difficult to conceive of much that may be said as to the advantages of this method.

### Disadvantages of Direct-Labor Cost Method

It has been shown that the greater part of all indirect expenses are really increased or diminished according to the *time* it takes to do the jobs, as well as according to the number of jobs completed. The severest criticism, therefore, of the direct-labor cost method is the fact that it is not based on *time* but on *cost*. Inasmuch as time is the most important factor which affects burden, any burden method based on factors other than time is inherently faulty. But the dominant weakness of the direct-labor cost method is too often overlooked because of its simplicity and convenience.

If the uniform conditions mentioned on page 422 are not present, the direct-labor cost plan is disadvantageous. The following tabulation will serve to illustrate the point: Assume that a considerable difference exists between the rates of pay of two workers, A and B—A gets 80 cents per hour, and B, 40 cents per hour—and that each can complete a given job in 5

hours. Assume further, that the departmental burden rate is 50% based on direct-labor cost, and that each of the jobs consumes material costing \$1.

## A

Material .....	\$1.00
Labor (\$ .80 x 5) .....	4.00
Burden (50% of \$4) .....	2.00
	<hr/>
Total manufacturing cost .....	\$7.00

## B

Material .....	\$1.00
Labor (\$ .40 x 5) .....	2.00
Burden (50% of \$2) .....	1.00
	<hr/>
Total manufacturing cost .....	\$4.00

The example discloses that A's product is charged with twice the overhead that is charged to B's product. This is obviously wrong, as A is a better man, more experienced, and therefore requires less supervision. Even though this were not true, what is the justification of charging *twice* the burden against A's job, when exactly the same elapsed time was spent by both, using the same value of burden in both cases?

### Advantages of Machine-Rate Method

The deficiencies of the direct-labor cost plan are strikingly apparent when brought into contrast with machine-rate plans, or a combination of machine-rate and labor-hours plan. Under all methods of distributing overhead, with the exception of certain machine-rate plans, overhead rates are calculated for whole plants or single departments, and not for individual machines or groups of machines. If one stops for a minute to consider the intricacy and complexity of technical processes in a modern plant, he is struck with the idea that homogeneous operations are limited to small areas. Machines and equip-

ment are vastly different and each machine affords a natural rather than an artificial unit for the incidence of burden. Machine rates, therefore, should be used in distributing part of the burden where production is dependent primarily on machines. Machine rates are computed in advance of actual incurrence of overhead charges. The total estimated overhead charges for an ensuing fiscal period are distributed over different work places (production centers, which may be work benches, machines, groups of like machines, or assembly spaces) according to different bases. The total charge for each work place is then divided by the estimated number of hours that the work place will operate during the period. Thus, the factors involved in the use of machine rates are predetermined, and subsequently actual conditions are compared with estimates. The plant may not run during all of the estimated period. But burden items proportional to time accrue anyway. Such charges are known as "un-absorbed burden."

The best development of machine rates is very simple, and consists of what may be termed a "super-rate" to cover machine expense. This method allows all the burden of a department, other than three items mentioned below, to be handled through the regular burden account, and be applied to the cost of machined work on the basis of direct-labor hours.

A special super-rate, however, is set up on either individual machine units or groups of approximately like machines, either from actual design of machines or from the standpoint that they are of about the same nature from a cost standpoint. A rate for each machine or group is set up, based on these three cost factors:

1. Depreciation
2. Power to operate
3. Maintenance



The great advantages of this method of having the regular general burden and a super-rate for machines are: simplicity, accuracy, and flexibility.

Imagine a machine or pair of machines threading pipe in a tube works. Some sizes require three men in the gang and others four. The work can even be done in a pinch with two men.

By this method we get the following:

Case 1—3 Men

1 man 5 hrs. at \$ .75 per hr. ....	\$3.75
" " " " " .60 " " .....	3.00
" " " " " .50 " " .....	2.50
<hr/>	
Direct labor 15 hrs. ....	\$ 9.25
General burden " " at \$.80 per hr. ....	12.00
Machine rate 5 " 1.50 " " .....	7.50
<hr/>	
<u>\$28.75</u>	

Case 2—4 Men

1 man 5 hrs. at \$ .75 per hr. ....	\$3.75
" " " " " .60 " " .....	3.00
" " " " " .50 " " .....	2.50
" " " " " .50 " " .....	2.50
<hr/>	
Direct labor 20 hrs. ....	\$11.75
General burden " " at \$.80 per hr. ....	16.00
Machine rate 5 " 1.50 " " .....	7.50
<hr/>	
<u>\$35.25</u>	

Note that the machine hours are the same, and that the flexibility and accuracy is shown by the simple addition of another man with his general burden for the number of hours he worked. This flexibility and accuracy is especially apparent in all cases where more than one operator is on a machine. It is just as apparent when an operator is running *more* than one machine.

**Disadvantages of Old-Style Machine-Rate Methods**

Except in a very few isolated cases, the great detail heretofore expended in the adjustment of machine rates has been too laborious and unnecessary. When it comes to great units like armor-plate forging, where the units require almost a whole building, then more detail must enter into machine rates. But these cases are in the great minority; and unfortunately it has happened that such conditions have influenced the attempt to apply an enormous amount of detail in shops of all kinds where it only resulted in ridiculous red tape and perhaps failure.

The setting aside of so much floor space for a group of machines or for an individual machine is in 99% of cases absolutely unnecessary. This is usually done with the aim of splitting up many and doubtful expenses and distributing them to each machine unit. Such an attempt at distribution usually causes a cost method to sink of its own weight.

The modest method of the super-rate, however, is one which gives very accurate costs and at the same time is simple and flexible.

## CHAPTER XXXIII

### INTEREST ON INVESTED CAPITAL AS A MANUFACTURING COST

#### **Importance of the Interest Problem**

A controversial point in cost accounting is whether or not interest on invested capital should be included as an item of manufacturing cost. The controversy in recent years has assumed renewed interest because of the movement toward the adoption of uniform methods of cost-finding. If costs of different plants are to be put on a comparative basis, the treatment of interest becomes a matter of vital concern.

In studying the interest problem, two pertinent questions arise: (1) What are the objects of cost accounting? (2) Is the inclusion of interest in manufacturing costs necessary to accomplish these objects? The answers to these questions form the subject matter of this chapter, attention being focused upon the arguments for and against the treatment of interest as a manufacturing cost item.

#### **Objects of Cost Accounting**

The objects of cost accounting may be broadly stated as follows:

1. To enable the business man to ascertain his manufacturing costs so that he may establish a selling price high enough to cover costs and to allow the desired profit.
2. To eliminate the waste incident to production.
3. To guide the business man in deciding what products he should make.

**Economic Cost and Business Cost**

To accomplish these objects, all business costs must, of course, be included in the accounts. Those who favor the inclusion of interest among manufacturing costs use economic theory to support their contentions. Those who oppose it emphasize rather the point of difference between economic cost and business cost.

The economic cost of an enterprise consists of the total payments made to production factors—land, capital, labor, and the entrepreneur. The respective payments are rent, interest, wages, and profits. Profits, according to economic theory, represent the difference between selling price and the costs of land, capital, and labor; they are a reward to the entrepreneur for combining the other production factors and for assuming the risk involved.

Ownership of capital is not a necessary qualification of the entrepreneur. If the enterpriser, however, owns his own land and capital, his only production factor cost is wages. In this case it is difficult to determine how much of the difference between selling price and wages is rent, how much is interest, and how much is profit. Interest, on the other hand, is a cost for the use of capital regardless of who owns the capital.

On the other hand, business or accounting cost is the cost calculated by the accountant from the business man's books. For analytical and other purposes, the accountant subdivides the costs of production factors into a number of accounts, and he keeps the accounts in such a way that profit is not recorded as a cost but is the result of a subtraction of business costs from the selling price. The terms "economic cost" and "accounting cost," therefore, are not synonymous nor are they equal to each other in amount. Neither the economist nor the accountant need concern himself greatly to make the concepts of economic cost and business cost agree, for each

makes his analysis of business activities with a different objective in view. The economist, as an economist, does not need to know the meaning of "memoriter account" to be able to study the causes of the rise and fall in prices. Nor does the accountant, as an accountant, require a knowledge of the quantitative theory of money to enable him to distribute manufacturing overhead.

Furthermore, the accountant's and economist's concepts of capital are not identical. The real difference lies in the conceptions of capital as an individual's property and as a social possession. The accountant regards capital as the difference between a firm's assets and its liabilities, while the economist may regard a firm's liabilities as the capital of that firm's creditors. The only case where the two concepts are the same is the unusual one where a firm has no liabilities.

The term "proprietorship"—or "net worth," or "present worth"—may be used to designate the accountant's conception of capital.

### The "Use" Theory

The inclusionists as well as the exclusionists, if the terms be allowed, say that no business man is foolish enough to ignore interest in his calculations before he sets his selling prices. The affirmative side then contends that interest is a charge for the use of capital—that the proprietor does not get capital for nothing—and hence a charge should be exacted for its use. The negative group states that there is a vast difference between a *charge* (debit in the account) for the use of capital and a *price* paid for the use of capital, and that the proprietor does not pay out anything for the use of his own capital (as distinguished from borrowed capital) employed in his business. Furthermore, they assert that books of accounts are primarily for the purpose of recording what has transpired in the business, for debiting values received and crediting

values parted with, and that one is arguing by analogy when he pleads for the inclusion of interest in accounts as a "cost" for the "use of service" of capital, simply because wages are paid for the use of services of labor. There is an actual outgo in the latter case but not in the former, which difference, it is claimed, is vital and fundamental. Furthermore, the plant may slow down or even stop if wages are not paid, whereas no similar results follow if entries for interest are not recorded.

But the other group counters with an argument expressed by C. H. Scovell in an address before the American Association of University Instructors in Accounting, December 27, 1918, as follows:

Unless business interest is included, it is impossible—

1. To compare the efficiency of alternative methods.
2. To measure the time element in costs.
3. To distinguish the profit on two or more kinds of business (such as jobbing and manufacturing) by the same management.
4. To measure the cost of carrying inventories larger or smaller, or of more or less valuable material.
5. To record accurately the costs, and therefore the profits, of complete or incomplete plants (a machine shop with or without a foundry, an automobile factory making or buying its engines).
6. To compare manufacturing costs in owned or rented plants.
7. To compare the cost of power generated on the premises with purchased current.
8. To reduce varieties of financing to common terms.
9. To make a uniform cost plan for associations.

In answer to this array of arguments, the negative side maintains that, although interest is considered by the business man in formulating his policies, it need not be booked, because provision for capital is a financial proposition and has nothing to do with production of goods. A general works manager, they contend, can be just as efficient with owned capital as with borrowed capital.

### **Depreciation Does Not Include Interest Charges**

Another argument against including interest as a cost is that depreciation is a charge for the use of capital and hence no need exists for regarding interest as a cost for the same purpose. That is to say, to record both depreciation and interest is double treatment for the use of capital. This point is avidly seized upon by the inclusionists and given a different slant by the claim that depreciation is a "cost of exhausting an asset—not a cost for its use unimpaired."

### **Fixed Assets and All Assets Methods**

When interest on invested capital is regarded as a manufacturing cost, several different methods of booking it exist. The interest charge is based on two factors: (1) the value of certain assets; and (2) the time such assets were in use (or will be in use), if interest is considered in predetermining the departmental burden rates to be applied to unit costs during a future period.

Some accountants use all assets as a basis in computing interest. The common practice, however, is to apply the interest charge only to fixed assets. This practice, exclusionists say, is an evidence of the strength of their position. Their opponents, however, state that this practice reduces clerical work, since the calculation of the changing values of working, trading, and current assets, and the time such assets are in use, even if possible, is extremely difficult. Consequently, theory must be sacrificed for common sense.

The interest entry for either one of the above two methods is:

Interest on Capital Investment.....	\$.....
Interest Charged to Cost or Interest	
Earned on Investment.....	\$.....

Exclusionists say this entry is fictitious because it does not represent anything paid out or received.

**Net Investment Method**

A third method of entering interest suitable for a trading concern or a small manufacturing plant which has only one inventory, is the net investment method. By "net investment" is meant the difference between the sum of all the assets: cash, notes, accounts receivable, raw materials, work in process, finished goods, prepaid interest, prepaid insurance, etc.; and the sum of all liabilities: notes and accounts payable, and all accrued items. The interest on plant, machinery, and equipment is handled through the rent charges. The net investment method obviously cannot be used in a large plant since the clerical work involved is prohibitive.

**Disposition of Interest Entries**

Under any of the above methods of booking interest, the charge becomes a part of manufacturing overhead and the credit is carried to some financial management account. Consequently, the charge and credit do not appear in the same section of the profit and loss statement. If no work in process is on hand at the end of the period, and all product made during the period is sold, the interest entry has no effect on the net profit. Some inventories, however, are usually on hand at the close of the period. Consequently the interest charged to inventories still on hand when statements are compiled inflates the value of inventories. Furthermore, inflated inventories treated as deductions from the sum of inventories on hand at the beginning of the period and costs incurred during the period, causes an understatement of expenses and an overstatement of profits. In other words, profits are anticipated. Accountants shrink from inflation of values and anticipation of profits. Moreover, the above circumstances might produce a profit even though no goods have been sold, a point which alone reveals the fundamental defect of interest inclusion in manufacturing costs.



### Commercial Objections to Including Interest in Cost

Whether or not one *believes* that interest inclusion inflates inventories and anticipates profits, it is a *fact* and not a *belief* that bankers do not regard interest as a legitimate cost to be added to inventories.

Furthermore, since the business world regards interest and dividends as of the same general nature, namely, as a return on invested capital, the inclusion of interest among costs would produce misleading financial statements.

### Interest Reserve Account and Interest Income Account Method

The criticism that interest inclusion inflates inventories and anticipates profits has led to the suggestion of the following method for treating interest, inserted here for general information.

Two special accounts should be opened in the ledger: (1) Interest Reserve account, and (2) Interest Income account. The interest, calculated for a current month, is charged as a cost in the same manner as any other cost item, while the total interest so charged is credited to Interest Reserve account. This account, of course, should not include or contain any interest charges which are actually paid for borrowed capital.

At the end of the current month, the amount of interest, . . . . should be ascertained and charged to Interest Reserve account, the offsetting credit being to Interest Income account. Any interest items affecting manufacturing costs which have been actually paid or received would also be charged, or credited, to Interest Income account. The balance of the Interest Income account would then be credited to Profit and Loss, while the balance of the Interest Reserve account would represent the interest on goods in process and finished stock. When the monthly financial statements are prepared, the Interest Reserve account is deducted from the inventory of goods in process and finished stock, as shown in the balance sheet.<sup>1</sup>

<sup>1</sup> Nicholson and Rohrbach, "Cost Accounting," page 140.

### Interest Included in Statistical Statements

The objects sought in including interest among costs can be secured equally well by entering interest calculations in statistical—not accounting—records, which may or may not be appended to financial statements. No wide-awake business man ignores interest in his calculations before formulating policies—but why clutter up the books with interest? To show the ridiculousness of interest inclusion, consider the case of a firm which manufactures a great variety of individual parts; these go into subassemblies and later into major assemblies. If interest is included in all of these cross-entries, the accounting is complicated to no good purpose.

### Pure Interest Rate

A potent objection to including interest in cost is the difficulty of selecting an equitable rate. Three different theoretical rates have been suggested :

1. A pure interest rate.
2. The rate at which money can be borrowed.
3. A rate sufficient to attract capital to the industry.

Difficulties arise in using any one of these rates.

Theoretically, the pure interest rate, as known to economists, is the rate that should be earned by capital where risk is zero. Practically, risk is not entirely absent even in the case of gilt-edged securities. Since it is impossible, therefore, to ascertain what the pure interest rate is, the serious presumption is raised that no such rate exists. However, if the so-called pure interest rate is adopted, it produces an insufficient charge for the use of capital because not all business hazards can be eliminated nor forecast. An interest rate close to zero does not measure the risks of modern business, as such risks are affected by so many factors that no one can possibly foresee what may happen.

### **Rate at Which Money Can be Borrowed**

The rate at which money can be borrowed depends on the supply and demand for funds and on the security of the borrower. This rate, according to the customary view, cannot be predetermined with any degree of exactness.

The Harvard Bureau of Business Research, however, recommends the use of "the ordinary interest rate on reasonably secured long-term investment, in the locality in which business is situated." In measuring the result of his business, as has already been pointed out, the business man, if he thinks about the subject at all, computes the amount of interest which his capital would earn if he invested it in something else. The bureau has determined from its inquiries that there seems to be in each locality a *definite idea* as to what constitutes a current rate of interest; others contend that the existence of this "definite idea" is a myth.

Consider the difficulty in choosing a rate under the following circumstances: Suppose a concern is considering the purchase of a machine with a life of 15 years, which will result in a yearly saving of 25% of the cost of the machine. It may be bought with the proceeds of an issue of 5% 15-year equipment bonds, or the proceeds of an issue of 7% cumulative preferred stock. With this alternative, what interest rate should be chosen for the capital tied up in the machine?

### **Rate that Will Attract Capital to the Industry**

Adoption of the rate that will attract capital to the industry might produce the impression that the manufacturer regarded the rate as an adequate return on his investment. Suppose that his rates are greater than his costs with interest included. Who is entitled to the difference? Labor, says the socialist, because capital has been fully compensated. On the other hand, the manufacturer's consumers might feel that the difference belonged to them. Neither contention would be

approved by the manufacturer, thus further complicating the problem.

From the foregoing discussion it is apparent that it is almost impossible to select a proper interest rate. This difficulty, however, does not discourage the inclusionists, who argue that depreciation is not ignored simply because it is difficult to measure. If the interest rate is reasonable, they say, why object to its inclusion?

All rate difficulties, exclusionists contend, could be avoided by regarding those who contribute capital to an enterprise as partners (not in the legal sense), who are entitled to their respective shares in the difference between selling price and costs (exclusive of interest). Furthermore, this treatment would decrease the distributable overhead by eliminating interest charges, and consequently would increase the accuracy of the costs.

### **Relation of Interest to Business Policies**

The greater the time element of storage and manufacturing processes, the greater the importance of the interest problem—this sums up the relation of interest to business policies. For example, material may be bought on speculation and stored when the management believes the price of such material will rise. The cost of storing material prior to its consumption must not be overlooked, however, before deciding whether the purchase of the material is profitable. Material of certain kinds, moreover, such as tobacco, lumber, and leather, is customarily stored because it must go through a seasoning process before it is ready to be manufactured.

Interest which runs on idle machines and equipment is a factor which influences decisions affecting manufacturing and selling policies. In times of curtailed production, shall the selling price of the product be cut with the hope that sufficient new orders may be secured to reduce materially or stop the

costs due to idleness of machines and equipment? Or shall the firm attempt to "hold" the market until business picks up? The answers to these questions depend vitally on the magnitude of the interest factor.

### **Motives for Including Interest in Cost**

Both schools of thought on the subject of interest have the courage of their convictions. The inclusionist group thinks the inclusion of interest will accomplish certain objects. Their motives, therefore, for including interest help to explain their contentions. One motive is undoubtedly that of self-interest. Somehow it is felt that a fair selling price is not established unless it is based on costs which include interest. While this motive is not reprehensible nor necessarily unwise for society, it is not per se an argument for including interest in cost. Just as satisfactory results could be accomplished by including interest in statistical—not accounting—records.

Another belief is that the scientific application of the economic principle of substitution or selection depends on the inclusion of interest in costs, i.e., that costs cannot be compared intelligently if the interest factor is ignored.

Another motive for interest inclusion may be the attempt to reconcile economic cost with accounting or business cost. The difficulties involved in such an attempt have already been discussed.

Another motive for including interest is to standardize cost. In answer to those who criticize this motive, it might be said that so-called "uniform systems" are moulded in their application to individual concerns to fit the exigencies of each case. If interest is included in costs in such systems, however, it usually is the same for all the members who adopt the system. As Lewis H. Haney said in an address delivered before the American Association of University Instructors in Accounting, December 27, 1918:

Now comes an effort to put a fixed return on investment into cost. Where will it end? Are we to reach some advanced economic stage in which the "industrial engineer's" art will enable the business man to sell "at cost" and still receive a return on his investment?

In view of the fact that purposes sought by interest inclusion can be equally well secured by including interest in statistical records, is not the accountant who favors inclusion performing an anti-individual and anti-social service?

### Legal Cases

The following cases decided by the courts disallow interest on invested capital as a manufacturing cost.<sup>2</sup>

In the case of Wolf Brothers and Company, complainant, v. Hamilton-Brown Shoe Company, defendant, the special master appointed by the United States Circuit Court of Appeals at St. Paul, disallowed interest on invested capital as a manufacturing cost. The master said:

It seems to me that the rule laid down by the Supreme Court of the United States in the following case, upon exceptions to the master's report, is the rule which must govern in the case at bar.

"He refused to allow manufacturer's profits and interest on the capital stock. This was correct. The profits made in violation of the rights of the complainants in this class of cases, within the meaning of the law, are to be computed and ascertained by finding the difference between cost and yield. In estimating the cost, the elements of price of materials, interest, expenses of manufacture and sale, and other necessary expenditures, if there be any, and bad debts, are to be taken into the account, and usually nothing else. *The calculation is to be made as a manufacturer calculates the profits of his business.*" (Rubber Company v. Goodyear, 76 U. S. 788-804.)

"The master properly refused to allow the defendant, as an element of the 'factory cost,' . . . interest on the capital of the corporation invested in its business." (Am. Ende v. Seabury, 43 Fed. Rep. 672.)

<sup>2</sup> *Journal of Accountancy*, Volume 16, page 145.

It further appears, so far as the books of the defendant show, that no interest upon the plant or upon the capital invested in the business was ever charged or paid by the defendant or ever entered into its calculations in estimating the gross or net profits of the concern in any year involved in this inquiry, nor ever until it appears in the Hart tabulation on page 8, in defendant's reply brief furnished me.

The testimony of Mr. Kribben, the expert accountant (*Record*, page 515), establishes the fact that the defendant, for its own information as to profit and loss, had its books audited annually by a firm of expert accountants.

Mr. Kribben's testimony and schedules which are compiled exclusively from the annual reports made to the defendant by its own experts, show that the defendant in its annual audit never charged the interest on its plant and capital against the profits. It is perfectly clear to my mind that the interest which defendant never charged against itself in estimating its own profits cannot in equity be charged against the complainant in diminution of the profits due the complainant under the decree.

If the defendant, for the purpose of diminishing the profits due complainant, claims to charge interest on its capital against the cost of production, it should also credit the interest earned on the capital with the amount so charged. This must result when the manufacturer draws a distinction between profits arising from production and interest on the capital.

It is a mere matter of bookkeeping. It is wholly fictitious. No money is paid out as an expense as interest on the capital. No money is received as interest on the capital invested. To make a correct balance of the books, the interest charged on the capital must be credited with the interest earned on the capital, otherwise the results will not balance. As the profit is thus shifted from one of manufacture to one of interest on the investment, the result is as broad as it is long. The general profits are not affected a particle one way or the other. No money passes one way or the other. The earnings are neither enlarged nor diminished.

This is undoubtedly the reason why the defendant's expert accountants did not carry interest on the capital into the overhead charges in diminution of the profits, because it would not be a legitimate charge for that purpose, and would not state the truth as a matter of accounting. No matter how the figures should be juggled, the profits still

remain with the concern unaffected, undiminished, and unimpaired.

Interest on actual borrowed money is an actual cash expense and must be allowed as a matter of course. The interest on the capital of the concern invested in its business is not a cash expense. It is represented by the production, and to carry out the fiction of charging interest on the capital as an outgo, it must be charged against the cost of production which will be diminished by just so much. If not, it diminishes the profits by just so much *on the books*, but not as an actual fact, for the profit remains the same. If the interest is added to the cost of production, it doubles the cost to that extent without any corresponding benefit. The capital is invested in the facilities for manufacture. The manufacture produces the profits. To charge the interest on the capital against the profits, and also to charge for the use of all the facilities of manufacture which represent the capital is, to that extent, to charge a double expense against a single profit. In an accounting for the profits due a complainant, such a charge amounts to a division of the profits, to that extent, between the sufferer and the wrong-doer.

I have made a careful examination of the authorities bearing on this claim for interest on the capital invested, which was not raised at the hearing before me, and I have been unable to find an instance in which the courts of last resort have allowed it to be charged in diminution of profits. Some cases have been cited to me in which the Supreme Court while refusing to allow interest on the capital invested, has declined to hold that it might not be allowed in some cases. From these dicta the inference has been drawn that when it can be apportioned it should be allowed. I am unable to agree with counsel in that view.

I am of the opinion that under the decisions nothing that is not actually an expense of production can be applied in diminution of profits.

In this case the proof shows that enormous sums have been paid as interest on borrowed money, amounting, during the period embraced in this inquiry, to \$503,875.33. These borrowed moneys, on which this great sum as interest paid is deducted from the profits, become borrowed working capital in business. The interest being actually paid is a legitimate charge against the profits. There is no proof or claim before me that the capital invested in the business upon which the defendant claims the sum of \$82,184.92



interest in diminution of the profits, is borrowed capital. If such were the case and such interest had been actually paid out to the owner of the borrowed capital as expense of production, it would have been as legitimate an item of expense as is the interest on borrowed money.

Not having been so paid, and never having been charged by the defendant upon its books as an expense of production in diminution of its own profits, it is a fictitious claim as against the complainant and cannot be allowed.

The following authority, which I did not see until after the above was written, supports the views here expressed.

"Where interest *has been paid* upon the capital invested or where it is to be paid upon borrowed capital, it should be allowed in estimating profits; but I am not aware of any rule which requires that it should be deducted where it has not been *actually paid* or incurred. . . .

"It was not shown that any interest . . . had been paid, or any indebtedness incurred therefor. The master was correct in not making any such allowance." (Herring v. Gage, 15 Blatch 129.)

See also the following:

"This item in the exhibit filed by the defendant's bookkeeper may have been the general cost of carrying on the entire business of the defendant, including its manufacturing departments, or it may be a mere approximation of expense of selling which would include *interest upon the general capital engaged*. If this is the fact, *this would be wrong*." (Kiesinger-Ison Co. v. Bradford B. Co., 123 Fed. 92.)

### Arguments For and Against Inclusion of Interest in Cost .

The arguments for the inclusion of interest in cost may be summarized as follows:

1. Economists regard interest as a cost.
2. Interest is a charge for the use of capital.
3. Interest inclusion bears a close relation to business policies.
4. Costs cannot be ascertained for material that is stored for seasoning unless interest is included.
5. The feeling of self-interest prompts the manufacturer to include interest.

6. Inclusion of interest in cost is necessary in order to carry out the economic principle of selection or substitution.
7. Inclusion of interest helps in the standardization of cost.

The arguments against including interest in cost may be summarized as follows:

1. Economic cost cannot be reconciled with business cost.
2. There is a difference between a charge and a price paid for the use of capital.
3. Interest entries do not represent values received or parted with.
4. Provision for capital is a financial and not a production proposition.
5. Inclusion of interest in cost leads to inflation of inventories.
6. Inclusion of interest leads to anticipation of profits.
7. Interest inclusion might result in showing a profit on the books even though no goods have been sold.
8. Bankers shave down inventories by the amount of interest included.
9. Interest inclusion produces misleading financial statements.
10. Interest can be shown in statistical statements and kept out of the books.
11. There is difficulty in selecting an equitable interest rate.
12. Legal decisions are against interest inclusion.

The weight of evidence seems to favor the exclusion of interest from manufacturing cost.

## CHAPTER XXXIV

### MECHANICAL DEVICES AS AIDS TO COST ACCOUNTING

#### **Need of Mechanical Devices**

The cost accountant, like the artisan, should be familiar with the use of tools—that is, with mechanical devices—which will aid him in his work. Mechanical devices bring about many economies which will be discussed later. The use of mechanical devices is the practical application to cost accounting of the principle of division of labor which was first carried out in the manufacturing division of an enterprise because of the desire of the management to get out as large a volume of product as possible. At first this principle was little applied to administration and distribution. But as surplus stock accumulated, an increasing amount of attention had to be devoted to administration and distribution. This called for closer co-operation and correlation of the production, selling, and administrative divisions of an enterprise and for specialization with an application of the principle of division of labor to office work. It has been proved by experience that mechanical devices greatly speed up office work and save clerical labor.

No attempt is made in this chapter to discuss in detail the operations of mechanical devices, because one can learn more in a few hours of practical instruction in the operation of machines than he could by long hours of study of books dealing with the subject. Consequently, in this chapter attention is given primarily to mechanical devices as aids to cost accounting. Space will not allow an adequate treatment even of this subject. But the student should know the broad classes of

machines and learn their operation and use from actual experience.

### **Classes of Mechanical Devices**

The mechanical devices discussed in this chapter may be classified as follows:

1. Calculating machines
2. Time and job-cost recording machines
3. Punching, sorting, and tabulating machines
4. Bookkeeping and cost-accounting machines

#### **1. Calculating Machines—Method of Operation**

Most calculating machines are operated by keys and by handles or cranks. The keys are very similar to those on a typewriter, except that they are arranged in vertical rather than in horizontal columns. The columns are in "multiple order," i.e., in units, tenths, hundredths, and so on. The data needed as a basis for the calculation—whether the calculation be addition, multiplication, subtraction, or division—are first registered in the machine by rapid depression of the keys. By further depression of the keys and by turning the handle on the machine, the visible answer appears in the machine expressed decimally or in whole numbers, as the case may be. Sometimes the only function of the handle is to cancel the answer in the register preparatory to the beginning of a new operation.

#### **Minimizing Errors**

While mechanical devices in good running order do not make mistakes, the operators themselves may commit errors. No mechanical device, therefore, is absolutely fool-proof. No typewriter, for example, has yet been invented to prevent misspelling of words. Errors made in calculating machines are minimized by various safeguards.

### Uses of Calculating Machines

Calculating machines as aids to prompt calculation, compilation, and presentation of cost data are used:

1. To calculate and summarize material costs for each job and each department.
2. To figure physical inventories.
3. To add total hours of labor from clock cards.
4. To add total hours of labor spent by each worker on each job.
5. To add labor costs of each job.
6. To add hours of labor on the pay-roll.
7. To multiply hours of labor by wage rates in order to determine the wages due each worker.
8. To add and balance pay-rolls.
9. To make up denomination sheets which show amounts of each denomination of money to be obtained from the bank for pay-roll purposes.
10. To calculate total job costs.
11. To figure selling costs, sales and profits by salesmen, departments, or territories.
12. To figure percentages of various kinds.
13. To calculate selling prices when costs and desired profits are known.

### Use of Reciprocals

One of the most important uses of calculating machines is to figure reciprocals. A reciprocal or coefficient of a number is the quotient of 1 divided by the given number. For example, 1 divided by 5 gives the decimal equivalent .2, which is called the "reciprocal" of 5. In this case, multiplying any number by .2 gives the same result as dividing that number by 5, because .2 is the reciprocal of 5. Where a long list of numbers is to be divided by one divisor, laborious division is

avoided by the use of reciprocals. Specifically, reciprocals are used in various kinds of percentage work, such as in calculating costs per piece, per job, and per department; and in the preparation of pay-rolls and burden and expense statements.

The following is a concrete example of how reciprocals can be used in calculating the percentages of selling expenses by departments. The expenses of each department follow:

Department A.....	\$ 125.00
B.....	250.45
C.....	1,255.55
D.....	650.35
E.....	740.25
	<hr/>
	\$3,021.60

The old method of figuring the percentage that the selling expenses of each department bore to the total selling expenses, was to divide the latter figure into the selling expenses of each department. Much time is saved by the use of the reciprocal method in conjunction with the calculating machine. The procedure is as follows: Divide \$3,021.60 into \$1 in order to get the reciprocal of \$3,021.60, which is .0003309505. Instead of dividing \$3,021.60 into each of the selling expense figures, the latter are multiplied by the above percentage, which gives the percentage that the selling expenses of each department bears to the total selling expenses. The percentages are:

Department A.....	4.1369%
B.....	8.2886
C.....	41.5525
D.....	21.5234
E.....	24.4986
	<hr/>
	100%

## 2. In and Out Time-Recorders

Accurate timekeeping in a plant is facilitated by the use of keyless and self-winding master and secondary clocks, and

other time-recorders. The master clock in a given plant at certain intervals sends electric impulses to the secondary clocks, thus synchronizing the time throughout the shop. Employees are more apt to begin and stop work on time if the time is synchronized in all departments than would be the case if each worker depended on his own watch or on that of his neighbor. Thus time-recording devices are useful not only in keeping proper time, but also in correlating the activities of the different departments.

A time-clock is installed in each department for the purpose of registering the time each worker enters and leaves the department. This time—known as the “in” and “out” time—is registered on the clock card of each individual worker. (See Chapter XV.) One of the duties of the dispatch clerk—the time clerk—in each department is to see that “in” and “out” time is registered properly. This method of recording time is much better than the old brass-check and timebook methods.

The dispatch clerk by looking at the clock cards in the “in” and “out” racks in his dispatch booth can ascertain what workers are in and out.

Clock cards are checked against time cards—labor cards—by the dispatch clerks. This checking insures more accurate labor records and hence facilitates the preparation of pay-rolls in more ways than one. Complaints of workers about time and wages due to clerical errors are considerably lessened by the use of time-recorders. Many errors and complaints can be adjusted before pay-day.

### **Job Time-Recorders**

There are a number of mechanical devices that stamp or record on time cards the starting, quitting, and elapsed times of jobs. Non-working time is subtracted, and overtime is added. Elapsed time is printed or stamped on job cards in

hours or minutes; or more usually in hours and tenths of hours. This time is permanent and cannot be altered. Some devices, however, do not record elapsed time. Time-recorders save considerable clerical work in calculating elapsed time by doing it automatically.

Job-recorders tend to eliminate the danger of inaccurate records and reduce the possibility of deliberate juggling of time. If labor records are written up at the end of the day from memory, some labor operations and costs thereof are apt to be forgotten.

### **Pay-Roll Machines**

Pay-roll machines—often called “steel paymasters”—figure the change list or schedule which shows the denominations of money needed from the bank for pay envelopes. If the pay-roll is divided into sections, it is preferable to prepare a separate schedule for each and to recapitulate all schedules on a grand schedule. These schedules are sent to the bank. Banks are glad to place money for each division in a separate bag.

Pay-roll machines help, therefore, to get pay-roll envelopes ready on time. Pay-roll work often has to be done in a hurry and any time-saver more than pays for itself. Another advantage of the pay-roll machine is that it gives a check on the pay-roll. If amounts due workers are properly registered in the machine, the addition of the amounts on the currency slip should agree with the pay-roll. While the pay-roll is checked in other ways, each additional check serves as an advantage.

Pay-roll machines not only make up denominations for the pay-roll, but also count the proper amount of money to be placed in each envelope and fill the envelope.

It is claimed by the manufacturers of pay-roll machines that they will fill on the average 30 to 35 envelopes per minute, and will do the work of eight clerks in this connection.



Some pay-roll machines also do calculating similar to that done by calculating devices.

### 3. Electric Sorting and Tabulating Machines

Electric sorting and tabulating machines comprise a battery or outfit of machines which are exceedingly useful to the accountant. The key punch and gang punch perforate circular holes in cards from the data on the cards or from other original records. The cards in many cases are the original records, such as time cards and material requisitions. Note the data shown on Forms 44 and 45.<sup>1</sup> As many as 45 columns sometimes appear on cards with a range of vertical figures in the columns from 0 to 9.

The number of cards punched per hour depends upon the amount of information to be shown by the perforations and on the skill of the operator. In some cases an average of 250 cards per hour are punched.

Punched cards are then placed in the sorter, which mechanically sorts cards according to the class of data desired, and registers subtotals and grand totals of cards which pass through the machine, and which is controlled in its operations by the perforations. Sorting is done at about the rate of 250 cards per minute.

The data on the sorted cards are tabulated on printed sheets or reports by the tabulating machine, according to group totals, money amounts, etc. Tabulating, like sorting, is governed by the perforations. Cards are tabulated on the average of 150 cards per minute.

The above-described battery of machines is leased to customers on a monthly rental which is very low considering the clerical work saved and the accuracy and promptness of data furnished to the cost accountant and executives, points which cannot be overvalued.

<sup>1</sup> See Chapter XV for other examples of labor cards.

REQUISITION FOR MATERIAL PLEASE DELIVER TO BEARER			HOLDEN MANUFACTURING CO. BOSTON, MASS.						AMOUNT
DESCRIPTION OF ARTICLE			ORDER NO.	PART NO.	DEPT.	CLASS	KIND	QUANTITY	AMOUNT
1 Standard Sets No. 1786			0 0 0 0	0 0 0 0	0 0 0	0 0 0	0 0 0 0	0 0 0 0	0 0 0 0
			1 1 1 1	1 1 1 1	1 1 1	1 1 1	1 1 1 1	1 1 1 1	1 1 1 1
			2 2 2 2	2 2 2 2	2 2 2	2 2 2	2 2 2 2	2 2 2 2	2 2 2 2
			3 3 3 3	3 3 3 3	3 3 3	3 3 3	3 3 3 3	3 3 3 3	3 3 3 3
			4 4 4 4	4 4 4 4	4 4 4	4 4 4	4 4 4 4	4 4 4 4	4 4 4 4
			5 5 5 5	5 5 5 5	5 5 5	5 5 5	5 5 5 5	5 5 5 5	5 5 5 5
			6 6 6 6	6 6 6 6	6 6 6	6 6 6	6 6 6 6	6 6 6 6	6 6 6 6
			7 7 7 7	7 7 7 7	7 7 7	7 7 7	7 7 7 7	7 7 7 7	7 7 7 7
			8 8 8 8	8 8 8 8	8 8 8	8 8 8	8 8 8 8	8 8 8 8	8 8 8 8
			9 9 9 9	9 9 9 9	9 9 9	9 9 9	9 9 9 9	9 9 9 9	9 9 9 9
J. B. M.			FOREMAN						

Form 44 Requisition for Material Card used with a Punching, Sorting, and Tabulating Machine.  
(Size,  $7\frac{1}{8} \times 3\frac{1}{4}$ .)

<b>1450</b>		<b>HOLDEN MANUFACTURING CO.</b>				<b>14</b>		<b>10/15/20</b>		<b>TIME CLOCK</b>	
<b>EMPLOYEE NO.</b>		<b>NAME</b>		<b>JOHN SMITH</b>		<b>DEPT.</b>		<b>DATE</b>			
<b>ORDER NO.</b>		<b>76980</b>		<b>Order No.</b>		<b>Part No.</b>		<b>Hours</b>		<b>Earnings</b>	
				0 0 0 0		0 0 0 0		0 0 0 0		0 0 0 0	
<b>PART NO.</b>		<b>OPERATION</b>		<b>Employee No.</b>		<b>Part No.</b>		<b>Hours</b>		<b>Earnings</b>	
<b>1786</b>		<b>12</b>		1 1 1 1		1 1 1 1		1 1 1 1		1 1 1 1	
				2 2 2 2		2 2 2 2		2 2 2 2		2 2 2 2	
				3 3 3 3		3 3 3 3		3 3 3 3		3 3 3 3	
<b>PIECES GOOD</b>				4 4 4 4		4 4 4 4		4 4 4 4		4 4 4 4	
				5 5 5 5		5 5 5 5		5 5 5 5		5 5 5 5	
				6 6 6 6		6 6 6 6		6 6 6 6		6 6 6 6	
<b>HOURS</b>		<b>RATE</b>		<b>AMOUNT</b>		<b>Hours</b>		<b>Earnings</b>			
<b>8</b>		<b>50</b>		<b>\$4.00</b>		<b>7 7 7 7</b>		<b>7 7 7 7</b>		<b>7 7 7 7</b>	
						<b>8 8 8 8</b>		<b>8 8 8 8</b>		<b>8 8 8 8</b>	
<b>JBM</b>						<b>9 9 9 9</b>		<b>9 9 9 9</b>		<b>9 9 9 9</b>	
<b>SIGNED</b>											

Form 45. Labor Card used with a Punching, Sorting, and Tabulating Machine. (Size, 7½ x 3¼.)

Tabulating machines are used in connection with the following:

1. Material ordered and received
2. Material requisitioned
3. Distribution of material charges
4. Pay-roll costs
5. Distribution of labor charges
6. Distribution of burden
7. Departmental production
8. Amount of defective work and scrap
9. Costs—by departments, jobs, etc.
10. Causes of idle time
11. Labor efficiency
12. Analysis of sales and cost of sales by products, departments, districts, and customers

The use of mechanical devices enables the cost accountant to present accurate and complete cost data in usable form to executives and subordinates. Inasmuch as these data are furnished promptly costs can be controlled at their source.

#### **4. Bookkeeping and Cost Accounting Machines**

The modern bookkeeping and billing machines are a combination of the typewriter and the adding machine; they add and subtract and also write, in one and the same operation. When the adding mechanism is disconnected, the machine may be used for ordinary typewriting.

The ledger posting machine posts original entries to either a loose-leaf or a bound-book ledger, and makes customers' monthly statements at one operation. By the use of this machine each ledger account is kept in perpetual balance, and the totals of debit and credit postings for successive days are accumulated—which furnishes instant proof of the accuracy of the postings. Thus the machine performs one operation

where two were formerly required of a clerk, and saves considerable time in the process. Total of the postings made each day to subsidiary ledgers are also secured for posting to controlling accounts.

Cost accounting machines cross-compute and add simultaneously cost data in all vertical columns in a tabulation. They post data to the ledger and a proof sheet in one operation. The following tabulation is an example of the work done by a cost accounting machine:

Percentage of Departmental Cost to the Total Cost

Dept. A.....	\$ 135.72	8.05%
B.....	267.56	15.87
C.....	236.75	14.04
D.....	13.57	.80
E.....	897.53	53.22
F.....	135.26	8.02
	<hr/>	<hr/>
	\$1,686.39	100.00%

Showing Distribution of Total Burden of \$13.56 to  
3 Departments According to Predetermined  
Departmental Burden Rates

Dept. A.....	\$13.56	25%	\$3.39
B.....		35	4.75
C.....		40	5.42
			<hr/>
			\$13.56

## CHAPTER XXXV

### GRAPHIC PRODUCTION CONTROL

#### **The Problem of Direct Cost**

Having the direct costs compiled for a job after it is completed is well worth the effort and expense, as in no other way can the direct costs of the operating departments be available for study and future action. On the other hand, post mortem figures of direct costs are of little value for the purpose of regulating the work to the greatest degree while it is going on. A very satisfactory method of regulating work as it is being done, however, is graphic production control.

Under this method of control, a study is made of preceding operations on work, new methods are devised to better the performance, and steps are taken to ascertain whether the desired improvements in operations are being realized. Graphic production control, therefore, as will be explained, is distinctly superior to so-called "predetermined" cost systems. Many of those systems involve the reducing of all costs to a standard monetary basis which includes not only the burdens, but also the direct-labor and direct-material costs. Under such predetermined cost systems, however, the management must wait till the end of a certain period before knowing whether or not a given department has completed the direct operations at or near the standard or predetermined cost. Thus while systems of predetermined costs give simply a post mortem control, graphic production control regulates current work.

#### **Fundamentals of Graphic Production Control**

Practically all fundamental requirements for the conduct of graphic production control are identical with those for cost

control. The principal points must be regulated in identically the same way, namely:

1. Materials must be under absolute control in stock-rooms.
2. Material stocks must be accounted for by stock records.
3. There must be complete specifications of product.
4. In connection with the specifications of product there must be complete specifications of the equipment to be used in connection with the various operations.
5. Labor records must be handled and safeguarded as in the case of cost control.
6. Dispatching in the shop, which is analogous to time-keeping under cost control, must be organized.

In other words, if a plant is to be organized for the control of either cost or production, the same fundamental requirements hold in both cases. Practically no additional cost, therefore, is involved in maintaining a method of graphic production control, if the plant is being organized for costs; and vice versa, if a plant is being organized for production control, no additional expense is involved in completing the full measure of cost control.

#### **Additional Fundamental Requirements**

In operating a system of graphic production control, the specifications of the product must be more detailed than in the case of cost control alone. As a matter of fact, however, a cost system when operated in conjunction with a system of graphic production control becomes more valuable than if operated alone.

In addition to the specifications of the product and the parts which make it up, the operation of graphic production

control requires that each individual piece be analyzed as to the operations necessary for producing it. In connection with each operation there must be specified the best machine on which this operation can be performed, and at least one alternate or next best which may have to be used if the best machine is already scheduled.

Also there must be, as a matter of permanent record, the best tools to use for each operation, with full detail as to the location and quantity of the tools on hand. This not only applies to the actual cutting tools themselves, but also involves the record of what jigs or other fixtures are on hand for performing each particular operation.

There is further required, although this particular feature should be present in a cost system as well, the rate per hour at which each operation on each piece should be performed. This is known as the "standard hourly production." This term means the number of pieces which can be produced per hour for each operation including assembly.

This rate per hour may be a decimal figure in case it happens to be less than 1. In the majority of cases, however, the rate is very liable to run into a whole figure and a decimal, as for instance, 9.7 pieces per hour.

### **Mechanism of Graphic Production Control**

In addition to the stock records, specifications of product, records of tools, etc., and the rates per hour of production, there is also required for the operation of graphic production control, a control board for scheduling or planning. The control board is placed usually at some central point convenient to the sets of dispatch boards located in the various departments.

### **Control Boards**

The control boards may be conveniently arranged to show on each face about fifty operating units or working places,



vertically. These working places may be machines, groups of machines, assembly benches, or individuals. Such a board is wide enough to show about thirty days of work in all, across the face of the board horizontally.

At the sides are shown the designations of the working places, the lettering being about  $1\frac{1}{4}$  in. in height. Across the top are arranged the dates which identify the 30 days shown on the board, each identifying space taking up about 2 in. Across the bottom and in exact registry with the top of the board there is another row of designating cards which identify each of the above dates as to the day of the week.

Attached to the top and bottom date and day lines are two runners, between which are stretched two silk cords which traverse the face of the control board vertically, and which indicate at a glance the day desired to observe on each working place.

At the left and right edges are located pockets for use in depositing cards as they are sorted out for entry on the board, and also for cards which have been taken from the board and are ready to be sent to the dispatch stations. The side pockets on the left are also used for depositing cards describing the working place for each horizontal line, giving thereon full data as to the capacity of the working place and full description of each piece of equipment represented.

The control board may be designed to use, as a scheduling medium, a cardboard strip which fits into grooves, or the board may consist of metal pockets in which are deposited the actual time cards. On the left-hand end of the card are shown the number of hours to be worked at standard rates.

If the boards consist of pockets and time cards are used, a control strip is deposited in the pocket back of the card on which is recorded the progress of work, when the work has been performed by the shop, thereby giving a current and usable record.

### Dispatch Boards

After the work in the shops has been planned on the control boards and the time cards have been sent to the shop, the next step is the arranging of the cards in the dispatch board.

Dispatch boards are of two kinds. One is a central dispatch board for the department. The board may be split into one or two sections if used in large departments, where from 50 to 200 operating units may be handled from one station.

Dispatch boards of the other kind consist of individual boards placed at working places.

The individual boards are used in foundries or in other departments where it is important to have on the time card certain directions as to the conduct of the job which is being performed.

The object of the dispatch board system is to have in the department the time cards already made out for the working places. The cards representing these places are arranged in the dispatch boards in the sequence of the jobs as they are to be done. This is most important, as in the majority of operating departments, there is a considerable percentage of more or less short-run work, in which from two to ten or twelve jobs are done each day at one working place.

It is the duty of the dispatch clerk in each department to—

1. See that the proper tools for each operation are delivered to the working place before the previous job has been finished.
2. See that the material to be worked on at each working place is delivered to the job before the previous job is finished.
3. See that completed work is taken away from each working place, and sent to the proper material station for the next operation.

4. See that the exact time spent on each operation is properly recorded on the time cards.
5. Check up all time cards to see that they agree in total for the day's work for each worker.
6. Record the idle time of each working place on an idle machine card.

It will be readily seen from the above that the dispatcher assumes a very important position in connection with the operating organization. He is in a position to be of the utmost assistance to the foremen, in that he carries the full responsibility for keeping equipment busy, and for bringing to the attention of the foremen lapses in connection with anything which is not going as it should. Moreover, as each time card which comes to the dispatcher shows the standard hourly rate which should be accomplished on each job, the dispatcher is in a position to have a constant check on the progress of the work.

In connection with the dispatch boards it is well to note that the board itself becomes a very valuable graphic illustration of the condition of the shop, and thus a powerful influence in accomplishing the best results in getting out work and in keeping all pieces of equipment running to full capacity.

This is facilitated by the use of different colors for the various cards. Productive work, for instance, is indicated by white or cream-color cards; indirect or standing order work by green cards; idle machines by light red or pink cards. In many cases the productive work is represented in two colors, one representing bonus or piece work, and the other straight daywork. The display of the different colored cards shows instantly the prevailing conditions in connection with each working place in the shop.

The effectiveness of the system may be noted, for example, in connection with idle machines. The idle machine cards,

according to the above scheme, are in pink. It is striking indeed to look at a board where perhaps 25% of the cards displayed are pink, showing that one-quarter of the machines in the shop are idle. It may be remarked that the most positive action is usually taken to get these machines into operation. All the various causes of idle machines are looked into—as, for instance, no operator; down for repairs; no work; no tools to work with; and all the other causes which result in machines being idle.

### **Use of the Control Board in Planning**

It has been noted already that there are standard records of the time required for each operation on each piece as expressed in the standard hourly production. All necessary data are, therefore, available for scheduling the various pieces as it becomes necessary to start them into manufacture.

As each piece comes up for scheduling it has already been ascertained whether or not the raw material for it is ready in the stockroom. This is accomplished by means of a requisition made out by the control department at the time the order was received, which is then passed through the stock record department, and marked as to whether or not the material is on hand.

The control board operator then takes the list of operations to be performed on the piece, goes through the various working places to see whether or not the “coast is clear” for the succeeding operation, making due allowance for being certain that one operation will be complete in time to transfer the material to the next operation, and schedules his work accordingly.

As stated previously, where the time cards are used as the actual schedule, these cards have already been made out in advance, or are made out at this time after it is known at just what time in the day the first card will be scheduled on

the board. After it has been determined just when the job is to be scheduled, the cards are dropped into the boards in the pocket which represents the working place being scheduled, sufficient cards being deposited to take up on the board the allotted number of hours which the particular job will fill. This procedure is carried out at each working place until each piece is properly scheduled.

It is thus possible to schedule every job with positive knowledge as to just when the piece can be completed. That in turn makes it possible to plan work in the shop so as to bring pieces required for any assembly operation to the stock-rooms in time to protect the assembly, without having to store many pieces for an undue length of time.

This procedure places the control department in a position to make intelligent promises for shipment—a matter of the utmost importance to the selling department. To do that means establishing an enviable reputation with the trade.

Sometimes, of course, because of lack of operators, breakdowns, and the like, changes have to be made in the scheduling. That, however, will occur under any circumstances. The advantage of graphic control is that these changes can be made with absolute intelligence and with full knowledge of the consequences which come from the failure of the mechanical department or the personnel department to keep up the supply of men and machines necessary to perform the work.

Another fact of importance is that with schedules presented in this graphic form, it is usually possible to take the less important part of the work off the schedule. Freeing the machines or working places for more important work helps to maintain the schedules which are vitally necessary.

### **Recording the Progress of Work**

The chief benefit of the system of graphic control—in connection with the subject of cost accounting—is that it

records the progress of work at the time it is going on. The tasks scheduled ahead for the working places are marked up on the control strip in green, indicating the number of standard hours of work which lie ahead.

The actual accomplishment made by each working place is recorded on the control strip in black—the marking covering the green line—indicating, similarly, the standard hours of work accomplished. It is to be noted here that the actual time of accomplishment is never recorded on the control strip, the language of the lines being that of standard hourly production only. To illustrate this point, the schedule of a simple case may be briefly followed through.

A certain piece to be manufactured requires two operations. Operation 1 is known to proceed at the standard rate of 10 per hour. The number of pieces to be made is 100. It has been ascertained that the raw material for the 100 pieces is in stock.

The number of working hours is 8 per day. The time required at the standard rate of 10 per hour to perform the first operation is 10 hours. Therefore, there are 10 hours of work ahead and 10 hours of material at the standard rate to supply this operation. On a time card is entered all the necessary information as to order number, working place, etc. The time card shows also the graphic scale of 8 hours divided into spaces of either half an hour or one hour. The graphic scale is filled in with a green mark for the full 8 hours. On a second time card 2 hours in green are filled in, which makes the two cards account for 10 hours.

Operation 2, at the rate of 2 per hour, will take 50 hours of work to perform as scheduled, and will require seven time cards—six full cards of 8 hours each, with 2 hours on a seventh card. The proper data as to order number, working place, etc., must be duly filled in, together with all other data called for on the card.

The cards for operation 1 are then inserted in the slot at the time when the work is scheduled and the cards for operation 2 are arranged in the slot which holds the cards for its particular working place, the first card of the string of 50 hours being placed at least 2 hours after the start of operation 1.

As the work progresses on operation 1, the reports from the dispatch station come in every hour or two as to the number of pieces completed. If the report comes in that 20 pieces are completed, this number of pieces at the standard rate of 10 per hour on operation 1 indicates that 2 hours' work has been finished. We then fill in on the control strip, which is in the board in place of the time cards which have been sent to the shop, a black line covering the space of two hours.

At the same time a second entry is made, but this time on operation 2. This entry will be in green on the time cards which are in the slot of operation 2, and will be for 20 pieces divided by the standard hourly rate of 2, which gives us 10 hours. We therefore fill in the graphic scale on the time cards 10 hours from the start of the job, which shows us plainly and distinctly that this operation has material ready for use for 10 hours of work.

### **Use of Progress Information**

The plumb lines stretched down the board indicate exactly what is going on in connection with each working place. By this means it is known exactly what is going on as each job progresses, and thereby all jobs which are lagging can be bolstered up.

According to the description in the previous section, if every job is running true to schedule the black line at the close of every day will come up to the plumb line which shows the end of that particular day's work. If the black line is back of the plumb line, it will indicate that this job is not progress-

ing according to schedule, and vice versa if the black line is ahead of the plumb line, it will indicate that the job is running faster than schedule. By this means foreman or superintendent is enabled to see on the control board exactly what jobs are not keeping up with the speed which the records show should be accomplished.

The causes of jobs not coming up to speed are many. The operator may be slow; on some particular day there may be no operator; the machine may break down; or the job may be delayed because the cutting tools were not ready. For all of these cases, special markers are provided to indicate on each job the cause of delay.

Thus the scheme of graphic production control, which is of course only very briefly described in this chapter, is designed to show, almost hourly, exactly how each piece of work is progressing in the shop.

Moreover, the information is given in such graphic form that the foreman or superintendent can tell at a glance not only on what jobs trouble is occurring, but the nature of the trouble. As a result, those responsible for operation can see instantly what problems require special attention, without having to spend time in investigation and figuring.

### **Effect of Graphic Production Control on Costs**

It may be quite readily seen that a close rein kept on the operation, through the medium of graphic production control, is designed to control direct cost at its source.

As has been previously stated, it is indeed of the utmost importance and value to have a cost sheet which shows exactly the result of each operation as to its cost. At the same time it must be admitted by everyone that a cost sheet showing the cost of a job after it is completed, is of no assistance when it comes to the actual performance of the work on the job, as the figures are good for comparative purposes only.



Graphic production control, therefore, is a means of having a constant knowledge of exactly how the work is progressing at the time it is going on, and places the operating head in a position to change men, get machines repaired, get tools ready, and otherwise safeguard the continuous operation of machines. The net result of graphic production control is, that if it can keep productive operations up to full speed, the direct-labor cost will take care of itself. It will mean that all the data on file in the cost office will be applied to a very practical and profitable use at the time when the work is actually going on.

Graphic production control is a natural accomplishment to go hand in hand with cost work. It has been brought out that the fundamental requirements for both cost and production control are identical. Cost work which is not broadened to produce practical and tangible results in the reduction of costs is a failure, and the natural outcome of cost work should, therefore, be extended to the absolute control of all operations as they are performed in the shop.

## CHAPTER XXXVI

### RELATION OF COST ACCOUNTING TO MANAGEMENT

#### **Need of Co-ordination**

There has long been a feeling that a sharp distinction exists between the plant organization and the executive management. Particularly in cases where the executive management is segregated from the plant, either in a distant city or in another part of the city, this has been apparent. It is natural enough for this feeling to exist, as there comes to be more or less competition between the operating departments and the office departments. Too often, however, there have resulted most unfortunate and regrettable relations between the so-called plant and office. That is the worst possible condition that can exist in a manufacturing institution, where, in order that the greatest benefits may be reached by both the plant and the executive management, full co-ordination and co-operation must prevail.

The cost department of a manufacturing institution is sometimes connected closely with the executive end, and in other cases still more closely connected with the operating end. Just as sure as there is a closer affiliation with one than with the other, just so sure this lamentable misunderstanding is bound to develop.

As a matter of fact, need of entire co-ordination between the executive management and the management of the operating departments cannot be emphasized too strongly. It is only when the executives are fully alive to all the problems of the operating department, particularly those which the operating department has to contend with every day, that they are

in the best position to perform the service which they, in their managerial capacity, are bound to perform. Likewise, those in charge of the operating end should be more closely in touch with the problems of the executive end, in order that they may intelligently handle their own work.

The logical department of the plant to effect this co-ordination is the cost department. That department has at command all figures in connection with all operations, and should be thoroughly in touch with all the circumstances which bring about the results set forth in the cost statements.

### **Strategic Position of the Cost Department**

The cost department is in the best position strategically of any department in the plant to effect co-ordination and bring about reforms and improvements which may mean the success or failure of the company. It is in a position to know in money value the efficiency of each operating department, and to know in the same way the efficiency of nearly every superintendent and foreman. It is thus in possession of more valuable information than any other routine department of the organization.

All members of the cost department, therefore, should keep in mind constantly that they carry a responsibility which is indeed very great and very grave. The information which they possess is confidential, except for those who are entitled to receive it. The use of the information is far-reaching with respect to the management as well as to the departments affected.

### **Conduct of Cost Department Employees**

All members of the cost department must bear in mind that because of their unique position great care must be taken as to their conduct in connection both with executive managers and with those responsible for operation. The work of the depart-

ment must be conducted along dignified and absolutely unbiased lines. In many cases, cost department men have been known to discuss results of one department with someone connected with another department, and in a manner more like gossip than necessary business discussion. Such conduct is most unfortunate; it is an abuse of privilege. Every member of the department must be most careful to use such information as he possesses only in a manner that makes for assistance and co-operation—never for personal criticism or condemnation.

### **Responsibility of Cost Department's Head**

The head of the cost department has the greatest responsibility in connection with not only the conduct of the department and the excellence of the cost figures secured, but also with the use of the knowledge collected by the cost department, in furthering the co-ordination between the executive management and the operating departments.

Like all others in the department, the department head is possessed of confidential information which must be used only in proper ways. He will be consulted by the executive management in connection with many problems which arise, and in his answers he must always hold to absolute straightforwardness and accuracy. He must be of a firm and yet considerate nature. He must have no likes and dislikes so far as personalities are concerned—as it will be difficult if not impossible for him to construe correctly the figures relating to the departments in charge of persons whom he dislikes.

He must at all times maintain a position of co-operation, and must use every endeavor to cull from successful departments the points which may be used in bringing up a department not so successful.

In this connection, an instance may be related of the head of the cost department in a large manufacturing institution.

A visitor was sitting in the office of a department head when the head of the cost department walked into the room. There was a smile on the face of the cost man, but in about two minutes a battle royal was on between the two men.

After the cost man had left the office, the department head remarked that he had very little use for the cost man. He went on to say that every time the cost man came into his office with a smile on, he knew that his department was in trouble—that it seemed almost a diabolical pleasure for the cost man to be able to come into his office with bad news. On the contrary, whenever the cost man came into the office with a long face, he knew that his department must have turned out some good results.

That is exactly the wrong way for a cost man to conduct himself. His own efficiency is absolutely crippled by having a man in the plant feel in this manner towards him, as he can expect no assistance or co-operation in any way when such a feeling is in existence.

When he goes into an operating office he should feel just as he would feel if he were in charge of the operations. Only when he has this feeling towards operations in the plant can he expect to make the proper headway in the work with which he is charged.

### **Relation Between Cost Man and Executives**

In dealing with executives, the cost man must be guarded in everything he says, not evasive by any means, but absolutely fair and free from bias in any opinions expressed as a result of the figures produced. This does not mean that he is to act as a shield for anyone who is not producing the right results in any particular department, but he must be absolutely certain of his knowledge of all conditions before either bringing up any bad situation for action, or expressing—even on request—any opinion in regard to a condition.

A cost man is in somewhat the position of a judge. The evidence consists of the data collected by his department in relation to conditions affecting the various departments involved in the plant. He is called in by the executive management, and very often what he says may swing one way or the other any proposition which is up for consideration. When he is certain of his ground he must take a decided stand and stick to it. But his attitude must be entirely fair and unbiased; he must eliminate all personal feelings and he must continually confine himself to the evidence. By the evidence is meant here the actual results accomplished by the department, or rather the procedure which is in question—not mere opinion.

The cost man is often called into conferences with the executives to assist in deciding as to new departments, new equipment, or the like. Here again; he should make it an invariable rule to confine his evidence to scientific facts, deduced from the past experiences of the business, and to eliminate personal opinions based on anything else.

He should be very careful, also, as to what he calls to the special attention of the executive management. He should always be sure that he understands all the underlying circumstances in connection with the figures. The figures alone, even when apparently unfavorable, do not always prove that a given department is at fault. For instance, when the rate per hour or the percentage on labor of the operating burden goes up, it may be found that the trouble is not due to the operating departments, but to the failure of the industrial relations department to supply the necessary workers. Countless other illustrations may be given. For the cost man to be in a thoroughly tenable position in respect to various problems which continually arise is a most responsible and difficult task.

In any event, the principal point regarding the relations of the cost man to the executive is that he must be absolutely square. If this is the fact his own sound sense will lead him

into very careful investigation of any matter before he influences the judgment of the executive one way or the other.

### **Importance of Cost Men's Position**

To repeat—the head of the cost department and all members of the department are in a most important situation in connection with the operation of an industrial plant. Whether the department rises to a rank of trust and importance, or its work remains in the class of clerical routine, depends wholly upon the mental attitude of the department head towards his duties. Unfortunately, many men who have entered the field of cost accounting have, by their own actions, relegated themselves to positions of simply high-class clerks. They have made out of the cost department no more than a figuring machine for assembling routine items—a position without dignity or standing.

No other department in an industrial organization has greater possibilities than the cost department. Its opportunities are unlimited. Those who are in a position to know the operations in such intimate detail are bound to become—unless they neglect their own opportunities—a power in the organization.

It lies wholly with the cost department as to whether it remains a routine department or becomes a powerful branch of the business. It rests almost wholly with the head of the cost department as to whether he becomes a big man in the organization, or whether he is content to remain in a mediocre routine position. But it should be borne in mind at all times that the guiding features in all cost accounting work should be honesty, fairness, and straightforwardness.

## CHAPTER XXXVII

### RECENT DEVELOPMENTS OF COST ACCOUNTING

#### **Movement for Uniform Cost Systems**

The movement for the adoption of so-called uniform cost systems has been greatly accelerated within the last decade by the Federal Trade Commission, the National Association of Manufacturers, the American Foundrymen's Association, and by other trade associations.<sup>1</sup> The Federal Trade Commission is entitled to unstinted praise for its efforts along this line. The commission has published three accounting pamphlets: "A System of Accounts for Manufacturers," "A System of Accounts for Retailers," and "Uniform Contract Costs—Definitions and Methods."

#### **Meaning of Term "Uniform Cost System"**

The term "uniform cost system" is often misunderstood as implying that all the features of the system selected—even the minutest details—are used uniformly by all concerns which adopt it. This is an erroneous impression. A better term for a uniform cost system is "uniform methods of cost-finding," which implies, correctly, that the system for a given industry is modified, if necessary, to meet the individual needs of each manufacturer in the industry who uses it. Still another term for a uniform cost system is "standard uniform cost-finding system." The United Typothetae and Franklin Club of America (printers) originally chose this name for their cost system. They changed it later to "standard cost-finding system."

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<sup>1</sup> See also in this connection E. A. Hurley's "The Awakening of American Business," for a discussion of the universal needs of better cost systems.



The early system of the Steel Foundries' Society of America was called "uniform methods of cost-finding for steel foundries"; the system of the American Foundrymen's Association, the "standard foundry cost system"; that of the National Association of Ice Industries, "uniform cost accounting system." The system of the Cover Paper Manufacturers' Association is called the "report of the committee on costs."

### **Uniform Costs Not Secured by Uniform Methods**

The use of uniform methods of cost-finding does not give uniform costs with regard to amounts, because the respective organization and efficiency of the different manufacturers in a given industry vary materially. Despite the apparent soundness of this last statement, a few economists believe that there is something sinister in the motives which prompt the use of uniform methods of cost-finding, particularly with respect to the inclusion of interest on invested capital as a manufacturing cost. These economists contend that price-fixing, which is prohibited by the Sherman Anti-Trust Law and the Clayton Act, is practically accomplished by the adoption of uniform methods of cost-finding. Their views, however, are not widely shared. It may be admitted that the use of uniform cost systems tends to stabilize prices in a given industry and to eliminate ruinous competition based on an inaccurate knowledge of costs, but this is an economic desideratum, not an evil. There are few indeed who are so bold as to say that manufacturers adopt uniform cost systems for the purpose of evading existing statutes.

### **Origin of Uniform Methods of Cost-Finding**

The origin of uniform methods of cost-finding has not been similar in the various industries. The customary method is for the manufacturers' association of a given industry to appoint a committee or commission on costs which

is given full power to devise a system. Sometimes the president of the association appoints the committee or commission.

The system referred to above which was adopted by printers was the result of the co-operative effort of printers in the United States and Canada. It stands as a testimonial to the value of organization. It was based on a set of fundamental principles adopted by five International Cost Congresses held by the American Printers' Cost Committee, and it was sanctioned by the Federal Trade Commission, as were many other uniform cost systems. Later, the system was indorsed by the United Typothetae and Franklin Clubs of America, by the district and state Cost Congresses, by local Ben Franklin clubs and Typothetae, various Master Printers' organizations, and by the Federation of Master Printers of the United Kingdom, Great Britain, and Ireland. The origin of this system is commented on in detail because of the fact that probably more agencies were interested in its adoption than in any other uniform cost system thus far adopted.

During the World War, the movement for the adoption of uniform methods was given additional impetus. A number of such systems were devised at the request of the War Industries Board. War service committees of industries which manufactured products essential to the successful prosecution of the war were notified by this board of the intention of the government to fix prices on certain staple commodities. In order to do this in an impartial manner for all members of a trade, it was deemed necessary to develop a uniform cost system for the whole trade.

The committee or commission on costs for an industry is usually composed of a group of auditors of the leading firms in that industry located in different parts of the country. This feature makes the group representative. If the matter of uniform systems is left to the members of the trade individually, little progress will be made, for the reason that most

manufacturers believe that it is the "other fellow" who is not correctly figuring his costs.

In the preparation of its system, the committee or commission either sends out a questionnaire to the members of the association, or talks with their accountants or auditors, or studies their records. Sometimes the system is finally perfected by an accounting firm, to eliminate the possible charge of bias that might be made if it were devised only by those representing the enterprises concerned.

### **Adopting the Uniform System**

The companies whose auditors draft the system are usually the first to install it, for the reason that their auditors are progressive and are selected for the task mainly because of their forward-looking characteristics. Some systems have been tried out in a few industries before being finally perfected and generally adopted. In some instances the systems have been adopted entire by firms just starting in business, while firms already in existence have at first adopted them only in part. Sometimes not one industry alone, but allied industries, have adopted the same system for their mutual advantage.

It is claimed for some systems that they are elastic enough to fit all conditions, and concerns of all sizes. This claim is hardly justified, since individual conditions usually warrant the modification of the *uniform* cost system to meet local and peculiar conditions. Even in drafting the system, a dissimilarity of individual cases is provided for by devising two cost systems. This was done by the lime industry. One system is intended for the small operator who has only two or three manufacturing processes; the other for the large operator who has more operating processes. But some systems—such as the one used by the printers' plants—can be used by both small and large plants.

Some uniform cost systems are so simple that they can be installed and operated by bookkeepers and accountants in the regular employ of the firms which adopt the systems. Others are more complex and can be successfully installed and nursed along only by outside cost accountants.

According to Nicholson and Rohrbach's "Cost Accounting," in devising uniform cost systems four main factors are considered, which are accomplished so far as is feasible. These factors are, they say:

1. Uniform classification of products.
2. Uniform classification of departments. A suggested broad classification consists of productive, non-productive, and miscellaneous departments.
3. Uniform classification of cost items.
4. Uniform treatment of cost items:

### **Advantages of Uniform Methods of Cost-Finding**

The World War, as much as any other one cause, brought manufacturers to a sharp realization of the advantages of uniform cost-finding. Although the war is over and governmental restrictions on many businesses have been removed, cost systems are even more valuable for the reconstruction period. In addition to the advantages of uniform cost methods already mentioned in Chapter I, the following—even wider in scope—are receiving today increasing attention:

1. Manufacturers at their association meetings can speak a common cost language in talking of their problems. They know what items should be included in cost, and hence will realize the necessity for including *all* costs.
2. Manufacturers have a growing sense of the duty they owe not only to themselves but also to their fellow-manufacturers and to the public at large. This quickened sense of duty has been partly due to the program of "unfair trade

practice" established by the Federal Trade Commission. Unfair trade practices cannot always be traced to a desire for monopoly or a desire to extort unfair prices from the public in defiance of the Sherman Anti-Trust Law and the Clayton Law; they are due often to ignorance of costs.

3. Prices can be set intelligently. The need for a cost system is well stated by Jason Rogers, publisher of *The New York Globe*, who says that advertising rates, as commonly set, represent what we think we can get rather than what we should insist on as a necessity of continuing solvent.

The fixing of selling prices which are too low because based on inaccurate costs, is not only detrimental to a given concern, but may confuse or destroy the concern's competitors and hence work havoc for the whole industry, for allied industries, and for the general consuming public.

4. By fixing selling prices based on accurate costs, concerns take a long step in insuring the buying public that they are paying fair and reasonable prices. According to the "Uniform Cost System of the National Association of Ice Industries," "The phrase 'Live and let live,' when modernized becomes, 'Live efficiently and let others live efficiently.'" A distinct service, therefore, is rendered not only to the trade but also to society by the men who devise a uniform cost system and by the firms which use it.

This happy condition is effected because firms send in their cost and statistical data to a central bureau of the association (a sort of clearing-house), which summarizes the data and makes it available for use by the members of the association.\*

If the individual firm's costs are higher than the average, it may discover where waste can be eliminated. It should "inquire constantly and carefully into the necessity of each cost." If the firm's costs are lower than the average, it is

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\* In this connection see E. H. Naylor, "Trade Associations." Ronald Press Company, 1920.

naturally elated. The individual firm which is using a uniform cost system can compare its selling prices with the average selling prices of all firms which have adopted the uniform system.

An example of valuable cost data sent to the members of a trade is found in the "Yearly Composite Statement of Cost of Production," compiled from the cost figures turned in to the central bureau of the United Typothetate and Franklin clubs of America by the members thereof, and made available as confidential information for the members. It is true that as yet not all of the members report their manufacturing costs, and that this failure detracts somewhat from the value of the statement. It is to be hoped, however, that in the future all printers, as well as the individual concerns in other industries with uniform methods of cost-finding, will make it possible for the full benefit to be realized from the exchange of cost data, by unselfishly co-operating with the central agency in charge of the compilation and dissemination of cost and statistical information. The benefit thus to be derived is enough of an advantage to warrant concerns in installing uniform cost systems.

A given firm may chafe at the delay in realizing the full advantages of its own system. But the system should be given a fair trial and used intelligently. Otherwise, the concern will miss part of its birthright and the greatest good will not accrue to the greatest number in the trade.

### **National Association of Cost Accountants**

A number of persons interested in promoting the growth of scientific cost methods—among them representatives of well-known industrial concerns, accounting firms, and educational institutions of the United States and Canada, organized in 1919 a National Association of Cost Accountants, the growth of which has been very rapid.

The fundamental object of this association, as set forth in a recent pamphlet, is to bring together and to promote cordial understanding among all persons interested in cost accounting. The more specific objects may be stated as follows:

1. To promote more intimate acquaintance and better understanding among cost men of all classes.
2. To collect, organize, and distribute among the members useful information dealing with all phases of cost work.
3. To develop, improve, and, so far as practicable, standardize the science and art of cost accounting.
4. To promote the study of cost accounting along scientific lines, through co-operation with recognized institutions and by means of publications issued under the auspices of the association.
5. To encourage young men who are preparing to take up cost accounting as a life work. To give them an opportunity to become acquainted with men of practical experience and to assist them in their studies by the distribution of sound information. A special class of membership, juniors, has been created to provide for those who are not able to meet the requirements for membership in the more advanced classes.
6. To protect the best interests of all members of the association by the establishment and maintenance of high moral standards within the association, and by aiding in the suppression of all practices which may tend to prejudice the good reputation of the profession of cost accounting.

## APPENDIX

### C. P. A. COST ACCOUNTING PROBLEMS

#### Problem 1

(a) Give a definition of a "unit" in cost accounting, and briefly explain its use.

(b) What cost unit would you recommend for the following industries:

- |                              |                    |
|------------------------------|--------------------|
| 1. Gas Plants                | 11. Water Works    |
| 2. Electric Lighting Utility | 12. State Prison   |
| 3. Brewery                   | 13. Tanneries      |
| 4. Coal Mine                 | 14. Flour-Mills    |
| 5. Passenger Railroad        | 15. Knitting-Mills |
| 6. Street Railway            | 16. Creameries     |
| 7. Paper-Mill                | 17. Quarries       |
| 8. Printing Plant            | 18. Cement-Mills   |
| 9. Brick Yard                | 19. Blast Furnace  |
| 10. Canning Factory          | 20. Foundries      |

(*Wisconsin*, 1916.)

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#### Problem 2

Iron Company "A" purchases on January 1, 1912, all the outstanding capital stock of Iron Company "B," and thereby acquires among other assets two blast furnace plants, viz., furnace No. 1 and furnace No. 2.

Furnace No. 1, of about 100 tons daily capacity, produces 18,000 tons from January 1 to July 1, 1912, and is blown out on this latter date for general repairs to the blowing engines. On September 1, 1912, operations are resumed after spending \$6,000. The furnace then produces 40,000 tons and is again blown out on October 1, 1913. This time, furnace and stoves are completely relined and, with the entire power plant and other equipment brought to full efficiency at a cost of \$40,000, it is expected that henceforth a provision of 20 cents



per ton of pig iron produced will be adequate to provide for future relining. It is blown in on January 1, 1914.

Furnace No. 2, of about 150 tons daily capacity, has been newly constructed. It was blown in on the date of purchase and has produced to December 31, 1913, 110,000 tons of iron. No more than ordinary wear and tear is perceptible, and the furnace may run for another year before a general relining, costing about \$30,000, is necessary.

How should the charges for relining furnace No. 1 be disposed of, and what provision should be made for the future relining of furnace No. 2 on December 31, 1913? (*Pennsylvania, 1915.*)

### Problem 3

You have been employed by two baking companies of Superior, the A Company and the B Company, to prepare a statement of the costs of a pound loaf of bread, and a pound-and-a-half loaf of bread delivered to the dealers. The amount of profit or loss per barrel and per loaf should be obtained. The operating expenses for March are to be used in your analysis.

The pound loaf is sold to the dealer for  $7\frac{1}{2}$  cents, the pound-and-a-half loaf for 11 cents.

The loaves sold are as follows:

	1-Pound Loaf	1½-Pound Loaf
A Company .....	93,000	254,500
B Company .....	145,080	377,475
	A Company	B Company
Materials Used .....	\$ 23,433.42	\$ 32,425.00
Productive Labor .....	2,500.00	4,000.00
Bakery Expenses:		
Non-Productive Labor .....	500.00	200.00
Heat, Light, and Power .....	125.00	300.00
Repairs .....	375.00	350.00
Depreciation .....	200.00	400.00
Insurance .....	200.00	325.00
Miscellaneous Supplies .....		250.00
Miscellaneous Bakery Expense .....	150.00	100.00

**Delivery Expenses:**

Agents' Salaries and Expenses.....	500.00	1,000.00
Drivers' Salaries .....	2,000.00	2,000.00
Shipping Department Expense.....	400.00	700.00
Stable Expense .....	600.00	1,200.00
Wagon and Harness Expense .....	250.00	350.00
Automobile Expense .....	700.00	1,500.00
Advertising .....	700.00	1,300.00

**Administrative Expenses:**

Officers' Salaries .....	2,000.00	3,000.00
Office Salaries .....	300.00	600.00
Office, Heat, Light, etc.....	50.00	60.00
Taxes .....	300.00	500.00
Depreciation .....	40.00	50.00
Stationery and Printing.....	75.00	250.00
Donations .....	100.00	75.00
Postage .....	25.00	50.00
Miscellaneous General Expense.....	100.00	125.00

The A Company further states that they are able to secure 270 pound loaves from a barrel mix, and 180 pound-and-a-half loaves from a barrel mix. The yield per barrel for the B Company is 267 pound loaves and 175 pound-and-a-half loaves.

In conversation with the officials of the company, they advise you in your analysis to group the expenses under four headings: materials, labor, delivery expenses, and overhead.

You may employ such distribution of the expense items as you deem best in view of the data presented and the nature of the business.

Prepare the report to the two companies as requested, and draw up a summary schedule showing the comparative costs, selling prices, and profits or losses for both sizes of bread for both companies. (*Wisconsin, 1918.*)

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#### Problem 4

A is the owner and operator of a stone quarry, which, owing to weather conditions, cannot be operated between December 1 and February 28. B caused damage to the quarry which delayed the commencement of operations until April 15, from which date the quarry was worked until November 30, and produced 71,000 cu. yds. at a quarry cost of 29 cents per cu. yd. The product from all sold at 77

cents per cu. yd. Overhead expense for the year, \$10,000. B repaired the quarry at his own expense. You are required by the lawyer for A to indicate the measure of consequential damage as a basis for action. In your answer illustrate your method. (*Illinois*, 1914.)

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### Problem 5

The Cinema Company, leasing moving picture machines for theaters, has 1,000 machines in operation. On January 1, 1915, the company decides to increase the number of its machines 80% and places an order with the manufacturers of the machines, who agree to complete and deliver the new machines in equal quarterly installments. The company arranges to borrow \$60,000, by the sale of five-year 6% notes, it being agreed that a sum equal to 20% of the total issue shall be set aside annually out of the profits of the company for the redemption of such notes. The average annual cost for maintenance was found to be \$120 per machine, and \$24,880 was estimated for other expenses.

What annual charge per machine would the company have to make in order to meet its obligations and pay a dividend of 10% on \$200,000 of its capital stock? (*New York*, 1915.)

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### Problem 6

The product of a garment factory consisted of only two grades of garments, viz., grade A and grade B.

There was no difference in the cost of materials and supplies consumed in the two grades, but there was a difference in other manufacturing expenses which it was impossible to keep separate as to the grades. If the factory ran exclusively on grade A the production would amount to 2,800 garments per week; if it ran exclusively on grade B the weekly production would amount to 3,500. The factory, however, made both grades at the same time. You were called in at the end of the first month's operation to audit the books and prepare cost statement. Your cost statement showed that the average cost per garment was \$6.60, excluding materials and supplies that cost \$5 per garment. Prepare cost statement and outline the procedure in connection with the audit. (*North Carolina*, 1919.)

**Problem 7**

A textile manufacturer operated his mill during a strike period extending from February 4, 1914, to July 8, 1914. The losses sustained by him during this period are to be compensated for by a manufacturers' association and the parties agree to the following:

The mill has 80 looms, but the percentage of loss is to be based on a standard of 60 looms, and only 75% of the looms which were operated are to be considered, in the adjustment of the loss, as having been in operation. The remaining looms are the basis for compensation.

Fixed charges were \$29,263 per annum. A further loss of \$4,112.45 occurred by reason of excess charges paid on loom labor and there was a loss of materials from theft and carelessness of strike-breakers amounting to \$500.

The total productive-loom hours accomplished were 43,064. The maximum hours per loom were 1,200. The normal production, at mill cost, would be \$119,203.47. Five per cent on actual loss of production was also to be paid.

Prepare a statement showing what the manufacturer is entitled to. (*New York, 1915.*)

**Problem 8**

1. A purchased a manufacturing business that had an inventory of finished product amounting to 5,000 lbs. He ran the plant one year and took inventory and found he had 8,000 lbs. of finished product on hand. You were called in to make an audit of the books and the examination disclosed he had sold 29,000 lbs. of product and the total cost of making the product amounted to \$12,800. Prepare a statement showing the cost per pound.

2. The product of a cloth-mill consisted of three grades of piece goods, designated as grades A, B, and C. The theoretical production per week per loom was as follows:

A .....	24.30 lbs.
B .....	28.60 "
C .....	32.20 "

The entire annual production of the grades was as follows:

A .....	100,000 lbs.
B .....	60,000 "
C .....	140,000 "

The raw materials used cost an average price of 60 cents per pound, and the total manufacturing expenses amounted to \$120,000. Prepare a statement showing the cost per pound for each of the three grades. (*North Carolina, 1919.*)

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### Problem 9

A manufacturing concern has been operating for a period of nine months, but owing to incomplete development of the plant the production during that period was greatly below the capacity and the cost of production consequently abnormal. The directors are anxious to obtain a statement not only showing the result of operations for the nine months, but one which would be fairly indicative of what the results would have been had conditions been normal. Assuming that the actual time lost on account of the frequent stoppages amounted in the aggregate to four months, would the auditor be justified in furnishing the latter statement as well as the former, and if so, how would you proceed to show the desired results from the following items?

Manufacturing Materials .....	\$39,865.69
Freight .....	5,489.22
Productive Wages .....	8,827.84
Non-Productive Labor .....	4,441.73
Salaries .....	6,877.29
Taxes and Interest.....	1,398.59
General Expenses .....	6,537.14
Sales .....	42,363.33
Finished Goods at Cost.....	7,346.45

(*Michigan, 1913.*)

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### Problem 10

1. (a) Discuss various methods of pricing commodities withdrawn from storerooms.

- (b) Discuss various methods of evaluating stores on hand.  
 (c) Explain necessary adjustments when physical inventories are more or less than amounts called for by storeroom perpetual inventory cards.

(d) What factors should be considered in determining minimum and maximum quantities of raw materials to be carried in stores?

2. (a) Differentiate between waste and shrinkage as found in manufacturing plants.

In cost accounting:

- (b) State three methods of treating waste.  
 (c) State two methods of treating shrinkage.  
 (d) State three methods of treating defective goods.  
 (e) State two methods of treating idle time. (*Wisconsin, 1916.*)

### Problem 11

From such facts as are submitted by the Cool Coal Company you are requested to distribute the indirect yard and office expenses in an equitable manner between the wholesale and the retail sales of hard coal and soft coal. State your reason for using the method you employ.

The indirect yard and office expenses amount to \$35,000.

The tonnage handled is as follows:

	Wholesale	Retail	Total
Hard Coal .....	2,500	10,000	12,500
Soft Coal .....	45,000	16,000	61,000
	<u>47,500</u>	<u>26,000</u>	<u>73,500</u>

The income from sales and the resulting gross profits are as follows:

	WHOLESALE		RETAIL	
	Sales Price	Gross Profit	Sales Price	Gross Profit
Hard Coal .....	\$ 21,250.00	\$ 1,000.00	\$105,000.00	\$18,500.00
Soft Coal .....	168,750.00	13,000.00	88,000.00	35,000.00
	<u>\$190,000.00</u>	<u>\$14,000.00</u>	<u>\$193,000.00</u>	<u>\$53,500.00</u>

(*Wisconsin, 1918.*)

## Problem 12

(a) From the following data, explain and illustrate four methods of distributing the indirect expenses of a factory to production:

Items	Dept. A	Dept. B	Dept. C
Materials Used .....	\$10,000.00	\$5,000.00	\$5,000.00
Productive Wages Paid .....	3,200.00	2,500.00	3,500.00
Productive-Labor Hours .....	8,000.00	5,000.00	10,000.00
Indirect Expenses .....	4,000.00	2,500.00	2,800.00

The factory is supposed to run 2,400 hours a year.

(b) Apply the results obtained in (a) to the facts given below for job No. 10, in order to show the different total job costs obtained by each of the methods. Assume the material and labor (value and time) chargeable to job No. 10, to be as follows:

Item	Dept. A	Dept. B	Dept. C	Total
Material .....	\$1.00	\$2.00	\$1.00	\$4.00
Labor Value .....	1.60	1.50	1.05	4.15
Labor Hours .....	4	3	3	10

(Wisconsin, 1916.)

## Problem 13

The treasurer of the United Manufacturing Company submitted the following figures taken from the ledger of the company, as representing the condition of the business, December 31, 1915:

Cash .....	\$ 7,500.00	
Accounts Receivable .....	45,000.00	
Notes Receivable .....	1,875.00	
Inventory:		
Raw Materials .....	\$20,000.00	
Labor .....	30,000.00	
Manufactured Goods .....	16,250.00	66,250.00
Accounts Payable .....		\$ 5,875.00
Notes Payable .....		20,000.00
Capital Stock .....		80,000.00
Surplus, December 31, 1915.....		14,750.00
	<u>\$120,625.00</u>	<u>\$120,625.00</u>

A comparison of the above statement with a former one showed a net loss for the period of \$6,250. The directors had expected a profit, basing their expectations on the result obtained by applying their cost calculations to the volume of sales for the period, and they employed an accountant to investigate the matter. All the nominal accounts had been closed into either the Merchandise account or the Profit and Loss account, and an analysis of these accounts disclosed the following:

**Inventory at Beginning of Period:**

Raw Material .....	\$ 22,500.00
Labor .....	32,500.00
Manufactured Goods .....	55,000.00
Purchases During Period .....	50,000.00
Labor .....	87,500.00
Wages .....	10,000.00
Traveling Expenses, Commissions, etc.....	26,250.00
Salaries .....	19,000.00
Rent .....	3,750.00
Bad Debts .....	6,375.00
Depreciation .....	1,500.00
Interest .....	625.00
Sales .....	250,000.00
Return Sales .....	7,500.00

The consumption of material and labor shown by the cost records was:

Material .....	\$45,000.00
Labor .....	80,000.00

Prepare a statement showing any discrepancy that may exist in the above figures; also a statement of assets and liabilities, December 31, 1915. (*New York, 1916.*)

### Problem 14

The following problem is based upon the estimate cost system. No factory ledger will be used, all accounts being kept on the general ledger. The business is the making of men's clothes, and two principal materials will be used, fine woolens and plain woolens, of which stock records will be kept. Stock records will also be kept for finished goods.



(a) The following styles of clothing will be made, and they are estimated to cost:

	Style 801	Style 802	Style 803
Material Used .....	\$12.50	\$ 8.00	\$ 4.00
Supplies (Linings, Buttons, etc.) .....	3.00	2.50	2.00
Labor .....	9.00	6.00	4.50
Factory Expenses, 60% .....	5.40	3.60	2.70
	<u>\$29.90</u>	<u>\$20.10</u>	<u>\$13.20</u>

Note that the estimated costs are subdivided into four sections, and that the accounts must be kept to record the corresponding subdivisions of operating costs.

(b) The company starts with the following:

	Dr.	Cr.
Machinery and Equipment .....	\$10,000.00	
Cash .....	40,000.00	
Capital Stock .....		\$50,000.00

(c) The purchases for the first month, according to voucher records, are:

Materials, Fine Woolens, 2,000 yds. at \$3.00 .....	\$ 6,000.00
Materials, Fine Woolens, 3,000 yds. at \$1.50 .....	4,500.00
Rent of Factory .....	500.00
Lining, Buttons, Thread, etc. ....	3,400.00
Salesmen's Commissions Paid .....	700.00
Office Expenses .....	120.00
Repairs to Machines and Equipment .....	350.00
Electric Power .....	440.00
Oil, Waste, and Other Factory Supplies .....	225.00
	<u>\$16,235.00</u>

(d) The pay-rolls are summarized as follows:

Foreman and Timekeepers .....	\$ 250.00
Tailors, Cutters, etc. (Direct Labor) .....	4,600.00
Office and Salesmen's Salaries .....	750.00
Inspectors and Other Indirect Factory Wages .....	435.00
	<u>\$6,035.00</u>

(e) Depreciation on equipment is calculated at 1% per month.

(f) The cutting-room foreman reports materials for use on garments in progress:

1,400 yds. Fine Woolens  
2,200 yds. Plain Woolens

(g) The tailoring foreman reports the following garments finished and placed in stock:

Style No. 801.....	200 pieces
" " 802.....	300 "
" " 803.....	200 "

(h) The sales record is as follows:

Invoice No. 1, Style No. 801, 100 Pieces.....	\$ 4,000.00
" " 2, " " 801, 50 " .....	2,050.00
" " 1, " " 803, 100 " .....	2,000.00
" " 3, " " 802, 100 " .....	3,000.00
" " 4, " " 802, 100 " .....	2,800.00
" " 4, " " 803, 25 " .....	450.00
	<u>\$14,300.00</u>

(i) Hint: Make entry for cost of sales.

(j) Received cash from customers \$9,000.

(k) Paid out cash for wages \$6,035, and vouchers \$7,650.

(l) Inventories at end of month. (In addition to stock of raw materials and finished goods as shown by stock records.)

Supplies, \$1,000.

Unfinished goods:

Style No. 801, 50 pieces:

All material cut.

All supplies provided.

Labor half completed.

Style No. 802, 100 pieces:

All material cut.

Half of supplies provided.

Half of labor finished.

(m) Prepare balance sheet and profit and loss account for the month.

Add or deduct from cost of sales, when preparing profit and loss account, the unabsorbed labor, expenses, etc.

(n) Show how balances of raw material and finished goods are made up. (*Institute Examination, November, 1918.*)

### Problem 15

The Standard Overall Company, employing piecework operators and estimating material consumption on the basis of specifications, has allowed its cost system to fall behind and employs you to pull the work together. You find that, starting the year, opening entries appear on your ledger as follows:

Finished Garments .....	\$ 110,000.00
Work in Process.....	5,000.00
Raw Material .....	20,000.00
Undistributed Departmental Burden.....	2,500.00
Undistributed General Factory Burden.....	1,000.00
Subsequent Transactions, per books:	
Material Purchased .....	500,000.00
Material Delivered to Cutting-Room .....	475,000.00
Productive Labor (Accrued), comprising 850,000 productive hours .....	250,000.00
Departmental Burden (Accrued) .....	100,000.00
General Factory Burden (Accrued), including 25,000 hours non-productive time .....	25,000.00
Selling Expenses .....	150,000.00
Administrative Expenses .....	80,000.00
Garments Completed, Delivered to Finished Stock.....	840,000.00
Garments Sold Valued at Manufacturing Cost.....	900,000.00
Sales (Net) .....	1,200,000.00
Taking of Inventory Necessitated the Following Adjustments:	
Raw Material (Short).....	3,000.00
Work in Process (Over) .....	500.00
Finished Garments (Short).....	1,500.00
Departmental Burden Rate (Flat).....	12 cents per hour
General Factory Burden Rate (Flat).....	3 cents per hour

Raise the necessary ledger accounts and show manufacturing, trading, and profit and loss statements, together with trail balance at close. (*Michigan, 1915.*)

### Problem 16

Prepare statements showing cost to produce and profit on sales of a small creamery, the books of which show as follows:

January 1, 1915, butter on hand, 1,000 lbs., valued at \$350; gathered and sweet cream purchases, 400,000 lbs., purchased on basis of butter fat test at 30 cents per pound butter fat; coloring matter \$250; other miscellaneous manufacturing supplies \$175; freight and commission on purchases \$325; labor cost for year \$9,500; insurance and taxes \$165.49; factory light and power \$975; depreciations on plant \$685.

Inventory, December 31, 1915: 485 lbs. of butter, valued at cost; other expenses, such as office salaries, \$5,635.50; postage \$175; repairs to office \$73.95.

Sales \$125,565; allowances for losses on shipments (to patrons) \$143.75.

Assume that  $1\frac{1}{4}$  lbs. cream tests 1 lb. butter fat, and 1 lb. of fat produces  $16\frac{2}{3}\%$  in excess weight of fat.

Show selling weight and price per pound realized from sales. (*Virginia*, 1916.)

### Problem 17

The following is a final trial balance of a rope factory, covering the year 1918, which began business January 1 of that year, except the value of the inventory of the finished product at the end of the year has not been ascertained and entered on the books:

	Debits	Credits
Cash .....	\$ 100,000.00	
Accounts Receivable .....	275,000.00	
Cost of Plant .....	300,000.00	
Office Expense .....	8,000.00	
Labor and Maintenance.....	200,000.00	
Cost of Power .....	10,000.00	
Machine Royalty .....	4,000.00	
Salaries of Officers.....	15,000.00	
Miscellaneous Factory Expense .....	5,000.00	
Depreciation for Year .....	15,000.00	
Miscellaneous Administrative Expenses .....	5,000.00	
Discounts Allowed .....	1,000.00	

Materials and Supplies Consumed.....	500,000.00	
Interest on Loans .....	2,000.00	
Accounts Payable .....		\$ 15,000.00
Notes Payable .....		200,000.00
Sales .....		900,000.00
Capital Stock .....		200,000.00
Reserve for Depreciation .....		100,000.00
Discounts Received .....		3,000.00
Surplus .....		22,000.00
	<u>\$1,440,000.00</u>	<u>\$1,440,000.00</u>

The total pounds of rope manufactured during the year amounted to 1,478,000 lbs. The inventory at end of year amounted to 200,000 lbs. The market price of rope at end of year was 40 cents per pound.

The corporation under T. D. 2609 adopted the method of taking inventories at cost or market, whichever is lower.

(a) Prepare a Profit and Loss account showing the profits for the year.

(b) Prepare a balance sheet of the assets and liabilities. (*North Carolina, 1919.*)

### Problem 18

A gas company shows the following trial balance at the end of its first year of business:

Capital Stock .....		\$ 500,000.00
Bonds .....		500,000.00
Accounts Payable .....		48,000.00
Gas Accounts .....		342,600.00
Manufacturing Labor .....	\$ 5,400.00	
Boiler Fuel .....	3,200.00	
Generator Fuel .....	5,400.00	
Oil .....	126,000.00	
Purifiers .....	3,200.00	
Repairs—Works .....	2,600.00	
Expense—Works .....	3,900.00	
Water .....	1,500.00	
Insurance .....	300.00	
Taxes .....	4,800.00	

Distribution Labor and Material.....	12,000.00	
Office Expense .....	13,500.00	
Stable Expense .....	4,000.00	
Repairs—Mains .....	1,800.00	
Repairs—Meters .....	600.00	
Repairs—Sewers .....	700.00	
Street Lighting .....	300.00	
Advertising .....	300.00	
Maintenance Arc Lamps.....	1,500.00	
Licenses .....	1,000.00	
Discounts .....	34,000.00	
General Expense .....	5,000.00	
Sundry Debtors, Gas .....	40,000.00	
Sundry Debtors, Merchandise .....	10,000.00	
Cash .....	29,000.00	
Bond Interest .....	25,000.00	
Plant .....	1,055,600.00	
	<u>\$1,390,600.00</u>	<u>\$1,390,600.00</u>

The inventory of manufacturing material is \$20,000.

The inventory of distribution material is \$4,000.

No other inventories of any description are carried.

The amount of gas manufactured during the year was 300,000,000 cu. ft. Amount sold, 270,000,000 cu. ft. Unaccounted for, 30,000,000 cu. ft.

Give first, the manufacturing cost of gas sold; second, the distribution cost of gas sold; third, prepare statement of operations of the company and balance sheet of assets and liabilities. (*Pennsylvania, 1904.*)

### Problem 19

A bicycle manufacturing company makes up its account December 31, 1909, for the year. The following are the debits to the Profit and Loss account:

Raw Materials on Hand January 1, 1909.....	\$12,500.00
Finished Machines on Hand January 1, 1909; 1,600 Wheels at \$30	48,000.00
Purchases of Material .....	62,500.00
Productive Labor .....	82,500.00

Manufacturing Expenses; Coal, Repairs, Paint, Varnish, Superintendent's Salary, Unproductive Labor, and Sundry Expenses..	23,000.00
Agents' Commissions .....	90,000.00
Branch Expenses, Rents, Salaries, and Miscellaneous.....	40,000.00
Selling Expenses, Travelers' Salaries, Discounts, Rebates, Miscellaneous .....	30,000.00
Bad Debts .....	8,000.00
Depreciation of Machinery and Plant.....	5,500.00

The sales for the year were 6,000 wheels, yielding \$540,000. The raw material on hand December 31, 1909, taken at cost, was \$4,000, and the finished wheels in stock ready for sale numbered 800.

Prepare an account from the above showing: (a) the number of wheels manufactured; (b) the manufacturing cost per wheel; (c) gross manufacturing profit; (d) the final net profit for the year, including in the net profit and loss account the stock of finished wheels on hand December 31 at their cost as shown by the accounts. (*Michigan*, 1909.)

### Problem 20

The accounts of a manufacturer of canned goods appear thus at the close of the fiscal year:

Factory Overhead Expense .....	\$ 12,682.78
Interest on Investment .....	4,039.75
Prime Factory Cost (200,000 doz.).....	164,954.92
Legal Expense .....	7,500.00
Inventory Finished Goods at Close (72,322 doz.).....	64,800.00
Bond Interest .....	800.00
Canned Goods Purchased (2,000 doz.).....	2,000.00
Interest (Debit) .....	432.50
Brokerage and Commission.....	3,055.37
Income Taxes (only) .....	1,573.89
Inventory Finished Goods at Start (20,000 doz.).....	18,000.00
Outward Freight .....	2,125.00
General Expense .....	2,874.71
Selling Expense .....	436.48
Sales Allowances .....	1,124.00
Sales (149,678 doz.) .....	?

It may be assumed that adjustments of inventory and accruals have already been made, except when the contrary is clearly inferred.

The United States government takes 25% of the goods manufactured, at cost to manufacturer plus 25 cents per dozen with the further stipulation that no charge shall be included for selling expense. As to sales to regular or civilian trade, the government also limits the manufacturer's profit on goods manufactured this year to 25 cents per dozen. Prepare a statement of the items which go to make the cost, income, and profit on each of these two classes of goods. (*Illinois*, 1918.)

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### Problem 21

In connection with the audit of the Citizens Gas Company, which manufactures only artificial coal gas, the following facts are disclosed:

1. The inventory of gas coal at June 1, 1916, was 1,000 tons.
2. During the year, 10,000 tons of gas coal were purchased and no coal was on hand at December 31, 1916.
3. A pound of gas coal yields 4.80 feet of gas of certain lighting and heating qualities.
4. The leakage was estimated at 5% of the gas manufactured.
5. Gas was sold to consumers at \$1 per thousand cubic feet and the total sales during the year 1916 aggregated \$75,000.

What criticisms would you have to offer on the above facts and what procedure would you adopt to make a comprehensive report to the management. (*Missouri*, 1916.)

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### Problem 22

The books of a corporation with capital of \$100,000, engaged in the manufacture of foundry castings, show after inventory, December 31, 1914, materials and finished work on hand as follows:

Pig iron \$5,500; heavy scrap iron \$300; foundry scrap \$165; coke \$640; limestone \$43; other materials \$690; finished casting \$250.

Inventory January 1, 1914, as follows: pig iron \$10,600; heavy scrap iron \$500; foundry scrap \$150; coke \$954.50; limestone \$65; other materials \$1,140; finished castings on hand \$1,075.



Purchases during the year as follows: pig iron \$125,600; heavy scrap iron \$5,400; foundry scrap \$125.60; coke \$16,000; limestone \$375; other materials \$7,325. Cash discount on purchases \$1,340.60: freight \$750.34.

The sales were \$250,000; carriage outwards \$1,265.10; discount on sales \$2,500; other expenditures, such as taxes, \$325; insurance \$175; labor \$53,250; foundry foreman \$2,100; office salaries \$2,500; travelers' salaries and expenses \$4,250; repairs and up-keep of office \$350.

15% depreciation on plant valued at \$50,000.

Prepare statement showing production cost and year's profit from operation. (*Virginia*, 1916.)

### Problem 23

The Mutual Distilling Company was organized on June 1, 1916, for the purpose of manufacturing alcohol from molasses. It started operations on July 1, 1916, and on December 31, 1916, the trial balance of the general ledger was as follows:

Real Estate .....	\$ 10,000.00	
Buildings .....	97,000.00	
Machinery and Equipment.....	145,000.00	
Capital Stock .....		\$250,000.00
Cash .....	5,700.00	
Accounts Receivable .....	81,500.00	
Bills Payable .....		105,000.00
Accounts Payable .....		15,183.00
Alcohol Sales .....		164,126.50
Freight (Outbound) .....	20,244.50	
Returns and Allowances .....	2,875.00	
Molasses .....	89,124.00	
Repairs and Replacements .....	1,806.50	
Cooperage .....	32,186.00	
Superintendence .....	1,700.00	
Factory Labor .....	6,766.00	
Fuel and Engine-Room Supplies.....	5,964.00	
Factory Supplies .....	5,742.50	
Brokerage and Commission.....	4,669.00	
Traveling Expenses .....	1,032.00	
Other Selling Expenses .....	500.00	

Salaries of Officers .....	6,000.00	
Salaries of Clerks .....	1,800.00	
Stationery and Printing.....	350.00	
Insurance .....	5,500.00	
Taxes .....	1,000.00	
Incidental Expenses .....	2,850.00	
Interest and Discount .....	5,000.00	
	<u>\$534,309.50</u>	<u>\$534,309.50</u>

During the six months the company produced 1,237,021 proof gallons of alcohol, 812,390 proof gallons were sold, and 424,631 proof gallons remain on hand, valued at \$44,458.

1,782,000 gallons of molasses were purchased, 1,682,000 were used, and 100,000 gallons remain on hand, valued at \$6,670.

Inventory of material and supplies as follows:

Cooperage .....	\$ 5,000.00
Fuel .....	500.00
Factory Supplies .....	500.00
Prepaid Insurance .....	1,500.00
Unearned Interest .....	700.00

A dividend of 5% on the capital stock was declared payable in January, 1917; all accounts receivable are considered good.

From the above figures prepare:

- (a) Closing entries.
- (b) Manufacturing and trading account (from inventory of manufactured product and raw material).
- (c) Profit and loss account. In making the closing entries make the necessary reserves for depreciation on buildings and machinery and equipment at such rates as you think proper.
- (d) Trial balance sheet.
- (e) Return of annual net income. (*Louisiana, 1917.*)

### Problem 24

During the month of July the By-Product Coke Company produces 60,000 tons of coke and recovers 250,000 gals. of tar sold at

3 cents per gallon, 700 tons of sulphate of ammonia sold at \$60 per ton, 300,000,000 cu. ft. of gas sold at \$100 per million cu. ft., and 3,200 tons of breeze and dust sold at 50 cents per ton.

The raw materials, direct labor, and expenses, as well as sundry operating and general works expenses, are as follows:

	APPLICABLE TO THE PRODUCTION OF			
	Coke	Tar	Sulphate of Ammonia	Gas
Coal .....	\$200,000.00	.....	.....	.....
Handling Coal .....	2,000.00	.....	.....	.....
Lime .....	.....	.....	\$ 1,000.00	.....
Sulphuric Acid .....	.....	.....	8,000.00	.....
Direct Labor .....	15,000.00	\$ 800.00	2,000.00	\$ 750.00
Steam, Water, Electric Light, etc. ....	3,000.00	500.00	1,000.00	600.00
General Yard and Switching .....	2,500.00	.....	100.00	.....
Laboratory .....	1,200.00	.....	300.00	.....
Operating Coolers and Exhausters .....	.....	150.00	.....	450.00
Operating Tar and Liquor Pump .....	.....	300.00	200.00	.....
Miscellaneous Supplies....	1,200.00	20.00	200.00	150.00
Repairs and Maintenance.	6,000.00	400.00	1,000.00	300.00
Provision for Relining and Renewals .....	1,200.00	.....	.....	.....
Provision for Depreciation.	1,500.00	300.00	500.00	600.00
General Works Expenses..	4,000.00	100.00	600.00	150.00
	\$237,600.00	\$2,570.00	\$14,900.00	\$3,000.00

Prepare statements showing the costs of making coke, tar, sulphate of ammonia, and gas, also show these costs per unit of production, viz.:

Per ton of coke.

Per gallon of tar.

Per ton of sulphate of ammonia.

Per million cubic feet of gas. (*Pennsylvania, 1914.*)

**Problem 25**

On January 1, 1914, the Arlington Company's records show the following conditions of its accounts:

Inventory of raw materials \$46,864.26; accrued factory pay-roll applied and distributed \$2,495.34; goods in process at prime cost \$191,665.32; the further value of \$24,111.51 for the factory overhead, also \$36,224.76 to cover superintendence; finished goods in stock show a total cost of \$64,968.03.

During the period from January 1 to December 31, 1914, purchases of raw materials amounted to \$241,249.35; factory pay-rolls \$377,381.70; superintendence \$114,300; factory expenses, including wages not applied to cost accounts, \$74,538; interest paid on notes \$3,600; dividends received \$15,012.

During the period mentioned, the operations in the factory comprised: raw materials requisitioned for consumption \$239,461.02; wages applied and distributed to manufacturing cost \$360,751.20; and to factory expenses \$17,878.17, included in the sum stated in the paragraph above.

There were also forwarded from the factory to the warehouse, finished goods at prime cost, covering materials \$235,627.74, and labor \$355,001.25. The cost of goods sold during the year was \$755,849.70, and the proceeds from goods sold \$907,019.64.

On December 31, 1914, the goods in process included, in addition to prime cost, factory overhead amounting to \$25,317.06, and superintendence \$38,035.98, and accrued factory pay-roll, applied and distributed, amounting to \$3,743.01.

Show the cost controlling accounts as they would appear in the general ledger, their operation, and the resulting net profit. (*New York, 1914.*)

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**Problem 26**

The Ohio Iron Company operates, for the manufacture of general iron work, a factory situated at a distance from the main office. All shipments are made from the factory, and all bills for sales are made by the main office.

No cost accounts have been kept in the past but they are now desirous of installing a proper cost system, including factory, work

in process, and stores ledgers at the factory. You are handed the following trial balance of their books as of June 1, 1913, the beginning of their fiscal year, as a basis for opening new records:

Cash .....	\$ 5,674.10	
Accounts Receivable .....	48,736.54	
Bills Receivable .....	8,940.76	
Machinery at Factory .....	25,780.94	
Small Tools and Supplies .....	3,760.92	
Office Buildings .....	5,000.00	
Factory Buildings .....	46,978.60	
Finished Goods Inventory .....	25,760.74	
Partly Finished Goods Inventory .....	16,987.56	
Raw Materials Inventory .....	12,879.25	
Factory Petty Cash Fund .....	800.00	
Bills Payable .....		\$ 12,760.00
Vouchers Payable .....		15,621.24
Capital Stock .....		150,000.00
Surplus .....		22,918.17
	<u>\$201,299.41</u>	<u>\$201,299.41</u>

During the month of June, 1913, the following transactions occurred:

Factory wages paid \$16,798.25. Unclaimed wages amounted to \$476.54, which are held at the factory until called for. Of the total amount of labor, \$12,578.22 is direct labor, and the balance indirect.

Materials purchased and received for use in factory work amounted to \$24,254.73; requisitions on the storekeeper for materials used in manufacture amounted to \$18,234.87; requisitions for materials used in repairs to machinery, shafting, etc., amounted to \$756.26; requisitions for small tools and supplies amounted to \$396.92.

Special jobs completed and shipped, cost to make, \$28,378.34; stock orders completed amounted to \$5,389.27; sales of finished goods from stock amounted to \$7,342.53.

Factory expenses for insurance, water rents, taxes, etc., amounted to \$3,897.23; depreciation on machinery is to be taken care of by setting up a reserve at the rate of 12% per annum.

Show an abstract of:

(a) Journal entry for general books to open factory ledger.

(b) An abstract of all factory ledger accounts as they should appear after the entries for June have been made, stating, by way of memo under the title of the several accounts, how they are supported by the auxiliary factory records controlled by them.

(c) Trial balance of factory ledger as at June 30, 1913. (*Ohio*, 1913.)

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### Problem 27

The main office of a manufacturing concern keeps the general books of the company and sells the finished product which is billed to it by the factory at cost. The cost books of the factory show the following facts on January 1, 1914:

Cash fund (imprest) \$500; raw materials and supplies \$15,910.32; work in process \$72,609.24; finished product \$40,219.57. A portion of the pay-roll distributed but not yet paid, \$3,553.42.

During the year 1914, the transactions were as follows: purchase of raw materials \$91,113.20; wages paid \$143,273.49; factory expenses charged \$103,699.16.

The raw materials and supplies used amounted to \$90,265.72; the factory expenses distributed \$103,834.43. There are also on hand unpaid local bills which have not been entered on the books, amounting to \$135.27, all of which were for factory expenses.

At the close of the year, December 31, 1914, there was unpaid and undistributed, the factory pay-roll for four days, amounting to \$2,942.10, and also 550 hours of overtime, payable at the rate of time and one-quarter, the regular day rate being 35 cents per hour.

The finished product made during the year, figured at cost, amounted to \$338,652.32; the amount of finished product transferred to the main office was \$340,192.45.

Write up all the ledger accounts on the factory books and show the final trial balance of December 31, 1914. (*Massachusetts*, 1915.)

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### Problem 28

The District Machine Company operates a factory cost system controlled by a double-entry factory ledger, the opening balances in which appear January 1, 1914, in part as follows:

Undistributed Burden .....	\$ 15,000.00
Raw Material .....	100,000.00
Work in Process .....	250,000.00
Finished Product .....	98,000.00
Accrued Pay-Roll .....	7,000.00

The following represent the total of the operations for given period:

Raw Material Purchased .....	\$225,000.00
Pay-Rolls .....	155,000.00
Productive Labor Distribution .....	150,000.00
Department Overhead .....	315,000.00
Raw Material Consumed .....	250,000.00
Product at Cost .....	825,000.00
Department Overhead Distributed.....	325,000.00
Sales at Cost.....	905,000.00

Raise the necessary controlling accounts to show the ledger record of the above operations, together with trial balance at the end of the period. (*Michigan, 1914.*)

### Problem 29

The Federal Manufacturing Company commenced business on January 1, 1917, with paid-up capital of \$2,000,000. It has a system of cost accounts which are controlled by the general books.

The trial balance of the company at December 31, 1917, was as follows:

	Dr.	Cr.
Cash .....	\$ 30,000.00	
Accounts Receivable .....	130,000.00	
Notes Receivable.....	25,000.00	
Raw Materials .....	150,000.00	
Overhead Burden .....		
Work in Process .....	100,000.00	
Finished Goods .....	300,000.00	
Dividends Paid .....	70,000.00	
Plant and Machinery .....	1,369,750.00	
Profit and Loss .....		\$ 23,250.00
Interest on Plant Investment .....		60,000.00

Accounts Payable .....	41,000.00
Notes Payable .....	500.00
Reserve for Depreciation.....	50,000.00
Capital Stock .....	2,000,000.00
	<hr/>
	\$2,174,750.00
	<hr/>
	\$2,174,750.00
	<hr/>

The general books of the company show the following charges and credit to Overhead account:

Factory Executive Salaries (one-third) .....	\$ 15,000.00
Indirect Labor .....	30,000.00
Cost Department Salaries .....	10,000.00
Superintendents' Salaries .....	10,000.00
Repairs of Machinery and Buildings.....	25,000.00
Power .....	5,000.00
Factory Supplies and Expenses .....	5,000.00
Depreciation of Plant and Machinery.....	50,000.00
Interest on Plant and Equipment.....	60,000.00
Salesmen's Salaries .....	20,000.00
Salesmen's Expenses .....	10,000.00
Advertising .....	30,000.00
Freight Outbound .....	10,000.00
Shipping Department, Labor and Expense.....	15,000.00
Officers' Salaries (executive, two-thirds).....	30,000.00
Office Salaries (Clerks) .....	15,000.00
Office Expenses .....	5,000.00
Cash Discount on Sales.....	15,000.00
Interest on Notes Payable.....	10,000.00
Allowances to Customers.....	10,000.00
Bad Debts .....	5,000.00
	<hr/>
	\$385,000.00

**Credits:**

Cash Discounts on Purchases.....	10,000.00
	<hr/>

Burden applied to cost orders in process during the year (equal to 100% of direct labor).....	\$375,000.00
	<hr/>

On making an examination of the accounts, you find that the purchase of raw material during the year amounted to \$500,000, that the cost of direct labor was \$375,000, and that the sales amounted to \$723,250.



An analysis of the orders in process discloses the following charges:

Materials .....	\$ 25,000.00
Direct Labor .....	37,500.00
Burden (100% direct labor) .....	37,500.00
	<hr/>
	<hr/>
	\$100,000.00

The number of units completed and delivered to the warehouse was 100,000, and of this number 70,000 units were sold.

You find that a dividend of  $3\frac{1}{2}\%$  was declared during the fiscal year and that no entry was made on the books.

You are asked to prepare a balance sheet and a profit and loss statement; also a statement showing the cost and net profit per unit.

Submit your working sheet. (*Ohio*, 1918.)

### Problem 30

The A Manufacturing Company operates a cost system and on March 31, 1919, the following balance is taken from their ledger:

Material (Opening Inventory) .....	\$ 3,000.00	
Material Purchases .....	8,084.32	
Labor (Total Pay-roll During Period).....	5,692.28	
Accrued Pay-roll—First of Period.....		\$ 200.00
Insurance Unexpired .....	828.00	
Taxes .....	1,095.00	
Reserve for Depreciation .....		1,240.00
Work in Process .....	2,000.00	
Finished Goods .....	3,754.00	
Power .....	483.00	
Miscellaneous Supplies and Expenses .....	985.85	
Sales .....		13,485.60
Sales Returns .....	865.20	
Sales Allowances .....	50.00	
Outbound Freight .....	120.00	
Selling Expense .....	1,120.53	
General Office Expense.....	1,090.73	
Discount on Purchases.....		165.40
Discount on Sales .....	95.00	
Reserve for Bad Debts.....		125.00

Accounts Receivable .....	8,600.40	
Accounts Payable .....		10,233.81
Cash .....	11,585.50	
Land .....	4,000.00	
Buildings .....	12,000.00	
Machinery and Equipment .....	50,000.00	
Capital Stock .....		100,000.00
Unissued Stock .....	15,000.00	
Surplus .....		5,000.00
	<u>\$130,449.81</u>	<u>\$130,449.81</u>

The distribution of the several factory expenses, among other accounts, is indicated in the tabulation on the following page. Vertical totals give the credits to the accounts used as columnar headings. The horizontal totals give the debits to the accounts listed at the left, which are obviously in addition to those given in the trial balance.

You are asked to open ledger accounts with each of the items listed above and with such other accounts as may be necessary in order to record:

- The closing entries and the appropriate revenue accounts.
- The operating or income statement for the month of March, 1919.
- The financial statement or balance sheet on March 31, 1919.

#### Notations

Cost of Sales Returns .....	\$ 597.12
Inventories, March 31, 1919:	
Material .....	4,600.00
Work in Process .....	4,024.86
Finished Goods .....	7,635.72
Accrued Labor .....	686.79
Factory Overhead Accounts Credited as Follows:	
Department A, 1,802 hours at 67 cents.....	1,207.34
"    B, 2,523 " " 52 " .....	1,311.96
"    C, 4,418 " " 15 " .....	662.70

An account receivable of \$64 from goods sold in December is considered lost; \$125 should be reserved for bad debt losses of the month.

- State the type of a cost accounting system which the above problem illustrates. (*Wisconsin*, 1919.)

## CREDITS TO ACCOUNTS

Debits to Accounts	Labor	Building Expense	Power	Insurance	Taxes	Reserve for Depreciation	Repairs	General Factory Expense	Miscellaneous Supplies and Expense	Totals
Building Expense .....	\$ 185.00	.....	\$ 84.10	\$12.00	\$20.00	\$ 40.00	\$ 65.00	.....	\$102.50	\$ 598.60
Power .....	300.00	.....	.....	8.00	10.00	40.00	.....	.....	.....	358.00
Repairs .....	356.40	.....	.....	2.00	2.50	13.33	.....	.....	215.00	589.23
General Factory Expense...	92.60	\$ 76.20	.....	.....	.....	.....	.....	.....	209.10	467.99
Factory Overhead Dept. A..	246.50	101.72	252.30	12.00	15.00	75.00	159.00	\$155.90	105.60	1,123.02
Factory Overhead Dept. B..	251.20	127.15	336.40	16.00	20.00	100.00	247.80	207.79	125.40	1,431.74
Factory Overhead Dept. C..	185.70	101.72	168.20	7.00	8.75	43.75	115.43	104.30	81.50	816.35
Shipping .....	117.00	50.86	.....	1.00	1.25	8.33	2.00	.....	56.75	237.19
General Expense (Office)...	.....	50.86	.....	14.00	16.75	8.33	.....	.....	.....	89.94
Totals .....	\$1,734.40	\$508.60	\$841.00	\$72.00	\$94.25	\$328.74	\$589.23	\$467.99	\$985.85	\$5,622.06

**Problem 31**

The main office of the Black Manufacturing Company is located in Milwaukee, but the factory is at Waukesha. The cost records are kept at the factory, but at the end of each month the necessary data is given the main office so that the proper accounts may be closed into the manufacturing account, compiled on the general books as a section of the general revenue account. Both cost and general books are kept by double entry.

The following accounts having to do with manufacturing appear on the general books of the Black Manufacturing Company, March 31, 1915, before closing entries are made:

Inventory, Jobs in Progress, March 1.....	\$ 3,000.00
Inventory, Finished Goods (not yet shipped) March 1.....	2,000.00
Inventory, Raw Materials, March 1.....	5,000.00
Raw Materials Purchased During Month.....	10,000.00
Productive Labor .....	5,000.00
Rent .....	200.00
Heat .....	50.00
Light .....	25.00
Power .....	150.00
Repairs to Machinery .....	150.00
Sundry Factory Supplies.....	25.00
Superintendence .....	300.00
Unproductive Labor .....	150.00

The following items of expense should also be considered in building up the accounts on the general books for the month:

Taxes (month's share).....	\$ 20.00
Insurance (month's share).....	15.00
Depreciation on Plant (month's share).....	300.00
The Accrued Productive Labor on March 31 amounts to.....	100.00

The cost records show the following data:

Materials Charged to Jobs in Progress During Month.....	\$11,000.00
Materials Charged to Finished Goods During Month.....	9,000.00
Labor Charged to Jobs in Progress During Month.....	5,100.00
Labor Charged to Finished Goods During Month.....	4,000.00
Indirect Expense Charged to Jobs in Progress During Month....	1,475.00
Indirect Expense Charged to Finished Goods During Month....	1,025.00
Jobs in Progress, Balance March 1.....	3,000.00

Finished Goods, Balance March 1.....	2,000.00
Manufacturing Account, Balance March 1.....	5,000.00
Sales, Goods Shipped During March.....	20,000.00
Finished Goods, Balance (goods not yet shipped) March 31.....	1,500.00

(a) Construct the accounts as they would appear on the cost ledger.

(b) Close the cost ledger.

(c) Give the journal entry connecting the cost and the general books.

(d) Compile the Manufacturing account on the general books, showing as the balance thereof the actual cost of goods sold during the month.

(e) Reconcile the profits as shown by the general books with those shown by the cost records. (*Wisconsin*, 1915.)

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### Problem 32

A textile-mill, employing some 700 hands, operates five departments, with a superintendent or head foreman in each. About 500 hands are paid upon a piecework basis, 50 on a part piecework and part day rate, according to the duties assigned to them from day to day; 100 are on a straight day-rate basis, while the remainder are paid weekly salaries but no overtime. Describe clearly and concisely the methods you would recommend for assembling and recording the data entering into the weekly pay-roll. Also state how you would have the pay-roll prepared and the wages, as shown thereon, paid to the hands, having in view both economy in clerical work and the securing of proper safeguards against frauds. (*Pennsylvania*, 1911.)

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### Problem 33

As a result of extended patent litigation, the A Manufacturing Company is ordered to account for the profit on the sales of a certain class of goods which they have been manufacturing. In reply to this order they submit a statement showing a very small profit on said sales.

You are called upon by the attorneys for the complainant and are advised that other manufacturing plants have made very large profits on this same line of articles, and that they desire to verify the correctness of the reports rendered. You visit the plant of the infringer and find that a very large number of different articles are manufactured, that no cost system is in operation, and that while the classification of sales is made as between the different groups of articles manufactured, that no separate costs appear upon the face of the general accounting books. You are also told by the company that in view of the fact that it made only limited total profits during the period under review, the profit on the articles in question could not be anything like what the attorneys for the complainant said should be the case.

State just what steps and what studies you would make and what books and records you would examine to determine either the correctness of the reports rendered, or the actual profits obtained from the articles in question, and to what extent, if any, you would tie up these results with the total results of the plant operations. Submit your answer in report form. (*Pennsylvania, 1917.*)

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### Problem 34

The Riverside Manufacturing Company desires to prepare monthly financial statements on sound accounting lines, although the books have not been kept so that the cost of the product may readily be determined therefrom. The trial balance as at January 31 (one month since the previous annual closing) is as follows:

Building .....	\$ 15,000.00	
Machinery, Machine-Shop .....	40,000.00	
Machinery, Carpenter Shop.....	5,000.00	
Power House and Equipment.....	10,000.00	
Cash .....	1,000.00	
Accounts Receivable .....	10,000.00	
Accounts Payable .....		\$ 5,000.00
Sales .....		23,000.00
Sales of Scrap Borings .....		50.00
Labor .....	6,850.00	
Repairs and Supplies .....	525.00	
Fuel .....	250.00	
Materials Purchased .....	25,000.00	

Salaries and Office Expense .....	550.00	
Capital .....		75,000.00
Surplus (December 31) .....		11,125.00
	<u>\$114,175.00</u>	<u>\$114,175.00</u>

The factory operates a machine shop covering 5,000 sq. ft. and using about 500 horse-power, and a carpenter shop covering 3,000 sq. ft. and using about 125 horse-power. Depreciation at 6% per annum on all capital assets is to be written off. An inventory at January 31 discloses the following:

Raw Materials .....	\$6,500.00
Goods in Process:	
Material .....	5,400.00
Labor of Machinists .....	1,200.00
Labor of Carpenters .....	300.00

It is required to reconstruct the accounts on a simple plan of cost accounting, showing the operations of the departments, and to prepare a balance sheet as at January 31.

On further analysis of the accounts, the expenditure for labor is found to cover the following:

Machinists .....	\$3,500.00
Carpenters .....	2,500.00
Machine-Shop Foreman and Clerks.....	300.00
Carpenter Foreman .....	150.00
Engineers .....	200.00
Superintendent .....	150.00
Watchman .....	50.00
	<u>\$6,850.00</u>

The expenditure for repairs and supplies covers:

For the Machine-Shop .....	\$275.00
For the Carpenter Shop .....	150.00
Building Repairs .....	100.00
	<u>\$525.00</u>

(Missouri, 1915.)

**Problem 35**

The factory of an automobile company assembles its cars only on receipt of orders from the main office. A summary of the factory operations for a certain period is as follows:

Parts Purchased .....	\$ 162,500.00
Parts Manufactured (material cost).....	562,500.00
Productive Labor (125% of material).....	703,125.00
Factory Expense .....	1,128,000.00
<b>Cost of Cars:</b>	
Parts Purchased, Consumed .....	137,500.00
Parts Manufactured (Material Cost).....	187,500.00
Productive Labor (145% of Material).....	471,250.00
Factory Expense .....	565,500.00
<b>Material on Hand, Unmanufactured .....</b>	<b>500,000.00</b>

Prepare a technical trial balance of the cost ledger and an inventory of the stockroom. (*New York, 1916.*)

**Problem 36**

The American Manufacturing Company commenced business on January 1, 1918, with a paid-up cash capital equal to the sales for the year 1918.

The net profits for the year 1918 were \$26,100.

Of the total charges to manufacturing during the year, 40% was for materials, 30% for productive labor, and 30% for manufacturing expenses (including 5% depreciation on plant and machinery, amounting to \$3,000).

The value of the materials used was 80% of the amount purchased, and 90% of the amount purchased was paid during the year.

The inventory value of finished goods on hand at December 31, 1918, was 10% of the cost of finished units delivered to the warehouse, and the work in process at that date was equal to 50% of the cost of units delivered to the warehouse.

The selling and administrative expenses were equal to 20% of the sales; also to 40% of the cost of goods sold. Ninety per cent of these expenses were paid during the year 1918.

Plant and machinery purchased during the year were paid for in cash.



All labor and manufacturing expenses (exclusive of depreciation) were paid in full up to and including December 31, 1918.

Of the total sales for the year, 80% was collected and 1% charged off as worthless.

From the given data you are required to prepare a balance sheet and a profit and loss statement, showing cost of goods delivered to the warehouse, cost of goods sold, and net profit for the year. (*Ohio, 1919.*)

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